

**UNITED STATES DEPARTMENT OF COMMERCE**  
**National Oceanic and Atmospheric Administration**  
NATIONAL MARINE FISHERIES SERVICE  
West Coast Region  
1201 NE Lloyd Boulevard, Suite 1100  
Portland, OR 97232

Refer to NMFS Consultation No.:  
WCR-2016-4993

July 9, 2018

Michelle Walker, Chief Regulatory Branch  
Seattle District, U.S. Army Corps of Engineers  
ATTN: Regulatory Branch (Bloxtown)  
P.O. Box 3755  
Seattle, Washington 98124-3755

Re: Endangered Species Act Section 7(a)(2) Biological Opinion, and Magnuson-Stevens  
Fishery Conservation and Management Act Essential Fish Habitat Response for the  
Electron Hydro Diversion Repair and Spillway Replacement located on the Puyallup  
River, Pierce County, Washington.

Dear Ms. Walker:

Thank you for your letter of May 3, 2017, requesting initiation of consultation with NOAA's  
National Marine Fisheries Service (NMFS) pursuant to section 7 of the Endangered Species Act  
of 1973 (ESA) (16 U.S.C. 1531 et seq.) for the Electron Hydro Diversion Repair and Spillway  
Replacement.

As required by section 7 of the Endangered Species Act, the National Marine Fisheries Service  
provided an incidental take statement with the biological opinion. The incidental take statement  
describes reasonable and prudent measures the National Marine Fisheries Service considers  
necessary or appropriate to minimize incidental take associated with this action. The take  
statement sets forth nondiscretionary terms and conditions. Incidental take from actions that meet  
the term and condition will be exempt from the Endangered Species Act take prohibition.

The enclosed document contains a biological opinion (opinion) that analyzes the effects of your  
proposal to permit the applicant, Electron Hydro, to replace portions of the diversion structure at  
the Electron Dam Headworks in Electron, Pierce County, Washington. In this Biological  
Opinion, we conclude that the proposed action is not likely to jeopardize the continued existence  
of Puget Sound Chinook and Puget Sound steelhead or destroy or adversely modify their  
designated critical habitats. The Electron Hydro Diversion project is a private utility and not  
covered by the Federal Power Act. As such, the applicant is preparing a separate application for  
an ESA section 10(a)(1)(B) Incidental Take Permit to cover continuing operation and  
maintenance of the project following completion of construction covered by your proposed  
permit. Therefore, continuing operation and maintenance of the diversion is beyond the scope of  
this consultation.

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This document also includes the results of our analysis of the action's likely effects on essential fish habitat (EFH) pursuant to section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA), and includes one conservation recommendation to avoid, minimize, or otherwise offset potential adverse effects on EFH. Section 305(b) (4) (B) of the MSA requires Federal agencies to provide a detailed written response to NMFS within 30 days after receiving these recommendations.

If the response is inconsistent with the essential fish habitat conservation recommendations, the COE must explain why the recommendations will not be followed, including the scientific justification for any disagreements over the effects of the action and the recommendations. In response to increased oversight of overall essential fish habitat program effectiveness by the Office of Management and Budget, NMFS established a quarterly reporting requirement to determine how many conservation recommendations are provided as part of each essential fish habitat consultation and how many are adopted by the action agency. Therefore, we request that, in your statutory reply to the essential fish habitat portion of this consultation, you clearly identify the conservation recommendations accepted.

Please contact Steve Copps, 206-526-6158, [steve.copps@noaa.gov](mailto:steve.copps@noaa.gov) if you have any questions concerning this consultation, or if you require additional information.

Sincerely,



Barry A. Thom  
Regional Administrator

cc: Jacalen Printz, COE

WCR-2016-4993

**Endangered Species Act (ESA) Section 7(a)(2) Biological Opinion and Magnuson-Stevens  
Fishery Conservation and Management Act Essential Fish Habitat Response**

Electron Hydro Diversion Repair and Spillway Replacement  
Puyallup River, Pierce County, Washington

NMFS Consultation Number: WCR-2016-4993

Action Agency: U.S. Army Corps of Engineers, Seattle District

**Affected Species and NMFS' Determinations:**


ESA-Listed Species	Status	Is Action Likely to Adversely Affect Species?	Is Action Likely To Jeopardize the Species?	Is Action Likely to Adversely Affect Critical Habitat?	Is Action Likely To Destroy or Adversely Modify Critical Habitat?
Puget Sound steelhead ( <i>Oncorhynchus mykiss</i> )	Threatened	Yes	No	Yes	Yes
Puget Sound Chinook ( <i>O. tshawytscha</i> )	Threatened	Yes	No	Yes	Yes

*[If the action has adverse effects on EFH, please include this table, otherwise delete.]*

Fishery Management Plan That Identifies EFH in the Project Area	Does Action Have an Adverse Effect on EFH?	Are EFH Conservation Recommendations Provided?
Pacific Coast Salmon	Yes	Yes

Consultation Conducted By: National Marine Fisheries Service  
West Coast Region

Issued By:

  
Barry A. Thom  
Regional Administrator

Date: July 9, 2018

WCR-2016-4993

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## 1. INTRODUCTION

This Introduction section provides information relevant to the other sections of this document and is incorporated by reference into Sections 2 and 3 below.

### 1.1 Background

The National Marine Fisheries Service (NMFS) prepared the biological opinion (opinion) and incidental take statement (ITS) portions of this document in accordance with section 7(b) of the Endangered Species Act (ESA) of 1973 (16 USC 1531 *et seq.*), and implementing regulations at 50 CFR 402.

We also completed an essential fish habitat (EFH) consultation on the proposed action, in accordance with section 305(b)(2) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) (16 U.S.C. 1801 *et seq.*) and implementing regulations at 50 CFR 600.

We completed pre-dissemination review of this document using standards for utility, integrity, and objectivity in compliance with applicable guidelines issued under the Data Quality Act (DQA) (section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001, Public Law 106-554). A complete record of this consultation is on file at the NMFS, Seattle Office.

### 1.2 Consultation History

This document represents NOAA's National Marine Fisheries Service (NMFS) biological opinion (opinion) based on our review of federal permitting enabling construction of the Electron Hydro, LLC, diversion repair and spillway replacement project located on the Puyallup River, near Electron, Pierce County, Washington, and its effects on Puget Sound Chinook salmon (*Oncorhynchus tshawytscha*), Puget Sound steelhead (*O. mykiss*), and critical habitat for Chinook salmon and steelhead, in accordance with section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 *et seq.*). Your May 3, 2017, request for formal consultation was received on May 8, 2017.

This opinion is based on information provided in the March 2017, Electron Hydro Project Biological Evaluation for Phase I Diversion Repair, Spillway Replacement and Bank Protection; the February 2017, Phase I Engineering Design Report for the Diversion Repair, Spillway Replacement and Bank Protection Project; and other sources of information cited in the opinion.

The following is a summary of important events associated with this consultation.

On June 28, 2016, NMFS staff conducted a site visit with other agencies including U.S. Fish and Wildlife Service (USFWS), the Puyallup Indian Tribe (PIT), Washington Department of Fish and Wildlife (WDFW), and the U.S Army Corps of Engineers (COE) to view the project and hear from Electron Hydro on engineering plans. The site visit marked the beginning of an ongoing dialogue between Electron Hydro and the agencies regarding the process for updating the facility and engineering specifications to ensure fish passage.

On December 20, 2016, Electron Hydro sent NMFS a notice of intent to prepare a Habitat Conservation Plan to address project upgrades and operations.

On May 8, 2017, NMFS received a letter and biological evaluation on the project requesting formal consultation.

On January 24, 2017, NMFS staff conducted a site visit and NMFS initiated consultation on January 25, 2018.

On an ongoing basis, the USFWS and NMFS have requested additional and clarifying information from the Corps and Electron Hydro.

### **1.3 Proposed Federal Action**

“Action” means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies (50 CFR 402.02).

The COE proposed to issue a permit under Section 404 of the Clean Water Act to Electron Hydro to enable construction of repairs and upgrade at the Electron Hydro Diversion Headworks on the Puyallup River in Electron, Washington. Electron Hydro proposes to replace the existing the diversion mechanism and related structure, replace the spillway, add a trash rack and sluice system to the intake, and replace and reinforce the bank protection at the Electron Hydro Project headworks under Phase I of a two phased effort to meet the requirements of the Endangered Species Act. The purpose of the project is to restore the integrity of the structures, keep sediment and bedload out of the intake structure, and prepare the facility for the installation of fine sediment and fish exclusion facilities.

Design, construction, operation, and maintenance of the sediment and fish exclusion facilities at the headworks will be covered by a proposed Habitat Conservation Plan (HCP) that Electron Hydro is preparing to submit as part of an application to NMFS and USFWS for an ESA section 10(a)(1)(B) incidental take permit (Phase II). The scope of this consultation is limited to Phase I. This consultation does not include the operation and maintenance of the facility under the HCP (Phase II), as the latter would be subject to its own, separate ESA section 7 consultation. Electron Hydro intends to complete, submit, and publish their ESA section 10 permit application and HCP to coincide with the completion of work covered in this consultation.

To ensure NMFS analyzed all of the effects of the new structure preceding coverage by the proposed ESA section 10(a)(1)(B) permit, NMFS determined that the effects of operation of the diversion for two years after completing construction are cumulative effects as defined at 50 C.F.R. 402.02. That is, those two years of operations are private activities, not involving Federal activities that are reasonably certain to occur within the action area of the Federal action subject to consultation. As such, NMFS analyzes the effects in the action area of the first two years of operation in this opinion at Section 2.6, Cumulative Effects.

Under the proposed COE permit, Electron Hydro will replace the existing 30-foot wide by 3-foot high Obermeyer three-gate spillway system and wooden apron with a 70-foot wide by 12-foot

high air inflated rubber bladder on a concrete foundation or slab (70 feet by 100 feet) within the existing footprint and alignment of the original diversion (200 feet by 100 feet). About 35 percent of the wooden diversion/spillway structure would be permanently replaced. The remaining diversion/spillway structure would be left in place.

Electron will replace approximately 935 feet of bank protection along the left (west) bank. This bank protection includes about 300 feet upstream from the intake wall and 635 feet downstream of the diversion structure wall. The existing west bank consists of 350 feet of riprap upstream of the intake wall, a 154 feet concrete intake/diversion wall (which includes the 52-foot intake), and 700 feet of riprap downstream of the diversion wall. The existing riprap both upstream and downstream of the diversion is approximately 12 feet in height. The replacement structure would be 27 feet total vertical dimension, with 15 feet of riprap placed below the existing riprap (below current riverbed elevation). The concrete wall along the diversion would be extended 150 feet downstream (304 feet total) with 50 feet placed behind the downstream riprap. The rock chutes would be extended so they discharge waterward of the riprap.

Concrete of varying depth would be placed in front of the existing intake structure to allow for the installation of a trash rack. A three-foot diameter slotted pipe would be installed along the base of the intake structure. A 3-foot radial gate would be constructed within the spillway abutment left wall at the downstream end of the slotted pipe. The slotted pipe and radial gate are designed to carry up to 120 cfs and allow fine sediments to be flushed in front of the intake structure without deflating the bladder spillway, primarily during the glacial melt period. The discharge for the pipe is on the dissipation concrete trough below the bladder.

Specific project in-water activities include:

- 1) Isolate and dewater the right side of channel to add a liner over wooden apron.
  - a. The applicant will sequentially isolate the worksite by placing Supersacks filled with onsite native gravel materials, across the upper section of the exclosure to move river flows to the left side of the channel. Gravel berms and a bulkhead (over the wooden apron) would be constructed along the side and bottom of the exclosure.
  - b. Install liner over wooden apron to reduce seepage into the construction area. The liner would extend 200 feet upstream and 400 feet downstream of the diversion (700 feet total). The liner would be approximately 130 feet wide. No gravel would be placed on top of the liner except at the upstream and downstream ends to hold the liner in place. The sides of the liner would be held in place by being buried within the berms constructed to dewater the river.
- 2) Isolate and dewater left side of channel and flume to repair and replace diversion structure.
  - a. Move supersacks from right side of channel to left side to divert flows down right side of channel. Extend berm upstream to enlarge area to be dewatered on left side of channel.
  - b. Remove spillway, excavate, and install rubber bladder, replace intake structure, extend rock chutes, and reinforce bank protection.

- c. Excavate approximately 19,500 cubic yards (1.5 acres) of sediment above and below the diversion dam. Excavated material would be used to make concrete for the spillway foundation, walls, and shoreline protection. Approximately 7,700 cubic yards would be used as back fill for newly replaced or repaired structures. Any remaining sediment would be stockpiled on site.

3) Remove supersacks, berms and liner.

The proposed action includes the following measures to avoid or minimize adverse effects of the action on listed species:

1. Electron Hydro will limit in-water excavating of bedload material in the active channel to seven days between July 15 and September 15 to limit exposure of ESA-listed fish to the effects of excavation.
2. Water quality monitoring above and below the construction site.
3. Fish would be excluded and removed from discrete work areas as work progresses using protocol and standards prepared by Washington Department of Transportation (2012).
4. A Stormwater Pollution Prevention Plan would be prepared to address specific actions to prevent petroleum products from being discharge into surface waters.
5. Water quality parameters would be monitored at two stations; one station upstream of the project area and one station 1,500 feet downstream.

## **2. ENDANGERED SPECIES ACT: BIOLOGICAL OPINION AND INCIDENTAL TAKE STATEMENT**

The ESA establishes a national program for conserving threatened and endangered species of fish, wildlife, plants, and the habitat upon which they depend. As required by section 7(a)(2) of the ESA, each Federal agency must ensure that its actions are not likely to jeopardize the continued existence of endangered or threatened species, or adversely modify or destroy their designated critical habitat. Per the requirements of the ESA, Federal action agencies consult with NMFS and section 7(b)(3) requires that, at the conclusion of consultation, NMFS provides an opinion stating how the agency's actions would affect listed species and their critical habitats. If incidental take is reasonably certain to occur, section 7(b)(4) requires NMFS to provide an ITS that specifies the impact of any incidental taking and includes non-discretionary reasonable and prudent measures (RPMs) and terms and conditions to minimize such impacts.

### **2.1 Analytical Approach**

This biological opinion includes both a jeopardy analysis and an adverse modification analysis or both. The jeopardy analysis relies upon the regulatory definition of "to jeopardize the continued existence of" a listed species, which is "to engage in an action that would be expected, directly or



indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species” (50 CFR 402.02). Therefore, the jeopardy analysis considers both survival and recovery of the species.

This biological opinion relies on the definition of "destruction or adverse modification," which “means a direct or indirect alteration that appreciably diminishes the value of critical habitat for the conservation of a listed species. Such alterations may include, but are not limited to, those that alter the physical or biological features essential to the conservation of a species or that preclude or significantly delay development of such features” (81 FR 7214).

We use the following approach to determine whether a proposed action is likely to jeopardize listed species or destroy or adversely modify critical habitat:

- Identify the rangewide status of the species and critical habitat expected to be adversely affected by the proposed action.
- Describe the environmental baseline in the action area.
- Analyze the effects of the proposed action on both species and their habitat using an “exposure-response-risk” approach.
- Describe any cumulative effects in the action area.
- Integrate and synthesize the above factors by: (1) Reviewing the status of the species and critical habitat; and (2) adding the effects of the action, the environmental baseline, and cumulative effects to assess the risk that the proposed action poses to species and critical habitat.
- Reach a conclusion about whether species are jeopardized or critical habitat is adversely modified.
- If necessary, suggest a RPA to the proposed action.

## **2.2 Rangewide Status of the Species and Critical Habitat**

This opinion examines the status of each species that would be adversely affected by the proposed action. The status is determined by the level of extinction risk that the listed species face, based on parameters considered in documents such as recovery plans, status reviews, and listing decisions. This informs the description of the species’ likelihood of both survival and recovery. The species status section also helps to inform the description of the species’ current “reproduction, numbers, or distribution” as described in 50 CFR 402.02. The opinion also examines the condition of critical habitat throughout the designated area, evaluates the conservation value of the various watersheds and coastal and marine environments that make up the designated area, and discusses the current function of the essential PBFs that help to form that conservation value.

One factor affecting the status of ESA-listed species considered in this opinion, and aquatic habitat at large, is climate change. Climate change is likely to play an increasingly important role in determining the abundance and distribution of ESA-listed species in the Pacific Northwest. These changes will not be spatially homogeneous across the Pacific Northwest. The largest hydrologic responses are expected to occur in basins with significant snow accumulation, where

warming decreases snow pack, increases winter flows, and advances the timing of spring melt (Mote et al. 2014, Mote 2016). Rain-dominated watersheds and those with significant contributions from groundwater may be less sensitive to predicted changes in climate (Tague et al. 2013, Mote et al. 2014).

During the last century, average regional air temperatures in the Pacific Northwest increased by 1-1.4°F as an annual average, and up to 2°F in some seasons (based on average linear increase per decade; Abatzoglou et al. 2014; Kunkel et al. 2013). Warming is likely to continue during the next century as average temperatures are projected to increase another 3 to 10°F, with the largest increases predicted to occur in the summer (Mote et al. 2014). Decreases in summer precipitation of as much as 30 percent by the end of the century are consistently predicted across climate models (Mote et al. 2014). Precipitation is more likely to occur during October through March, less during summer months, and more winter precipitation will be rain than snow (ISAB 2007; Mote et al. 2013; Mote et al. 2014). Earlier snowmelt will cause lower stream flows in late spring, summer, and fall, and water temperatures will be warmer (ISAB 2007; Mote et al. 2014). Models consistently predict increases in the frequency of severe winter precipitation events (i.e., 20-year and 50-year events), in the western United States (Dominguez et al. 2012). The largest increases in winter flood frequency and magnitude are predicted in mixed rain-snow watersheds (Mote et al. 2014).

Overall, about one-third of the current cold-water salmonid habitat in the Pacific Northwest is likely to exceed key water temperature thresholds by the end of this century (Mantua et al. 2009). Higher temperatures will reduce the quality of available salmonid habitat for most freshwater life stages (ISAB 2007). Reduced flows will make it more difficult for migrating fish to pass physical and thermal obstructions, limiting their access to available habitat (Mantua et al. 2010; Isaak et al. 2012). Temperature increases shift timing of key life cycle events for salmonids and species forming the base of their aquatic food webs (Crozier et al. 2011; Tillmann and Siemann 2011; Winder and Schindler 2004). Higher stream temperatures will also cause decreases in dissolved oxygen and may also cause earlier onset of stratification and reduced mixing between layers in lakes and reservoirs, which can also result in reduced oxygen (Meyer et al. 1999; Winder and Schindler 2004, Raymondi et al. 2013). Higher temperatures are likely to cause several species to become more susceptible to parasites, disease, and higher predation rates (Crozier et al. 2008; Wainwright and Weitkamp 2013; Raymondi et al. 2013).

As more basins become rain-dominated and prone to more severe winter storms, higher winter stream flows may increase the risk that winter or spring floods in sensitive watersheds will damage spawning redds and wash away incubating eggs (Goode et al. 2013). Earlier peak stream flows will also alter migration timing for salmon smolts, and may flush some young salmon and steelhead from rivers to estuaries before they are physically mature, increasing stress and reducing smolt survival (McMahon and Hartman 1989; Lawson et al. 2004).

In addition to changes in freshwater conditions, predicted changes for coastal waters in the Pacific Northwest as a result of climate change include increasing surface water temperature, increasing but highly variable acidity, and increasing storm frequency and magnitude (Mote et al. 2014). Elevated ocean temperatures already documented for the Pacific Northwest are highly likely to continue during the next century, with sea surface temperature projected to increase by

1.0-3.7°C by the end of the century (IPCC 2014). Habitat loss, shifts in species' ranges and abundances, and altered marine food webs could have substantial consequences to anadromous, coastal, and marine species in the Pacific Northwest (Tillmann and Siemann 2011, Reeder et al. 2013). Moreover, as atmospheric carbon emissions increase, increasing levels of carbon are absorbed by the oceans, changing the pH of the water. Acidification also impacts sensitive estuary habitats, where organic matter and nutrient inputs further reduce pH and produce conditions more corrosive than those in offshore waters (Feely et al. 2012, Sunda and Cai 2012).

Global sea levels are expected to continue rising throughout this century, reaching likely predicted increases of 10 to 32 inches by 2081-2100 (IPCC 2014). These changes will likely result in increased erosion and more frequent and severe coastal flooding, and shifts in the composition of nearshore habitats (Tillmann and Siemann 2011, Reeder et al. 2013). Estuarine-dependent salmonids such as chum and Chinook salmon are predicted to be impacted by significant reductions in rearing habitat in some Pacific Northwest coastal areas (Glick et al. 2007).

Historically, warm periods in the coastal Pacific Ocean have coincided with relatively low abundances of salmon and steelhead, while cooler ocean periods have coincided with relatively high abundances, and therefore these species are predicted to fare poorly in warming ocean conditions (Scheuerell and Williams 2005; Zabel et al. 2006). This is supported by the recent observation that anomalously warm sea surface temperatures off the coast of Washington from 2013 to 2016 resulted in poor coho and Chinook salmon body condition for juveniles caught in those waters (NWFSC 2015). Changes to estuarine and coastal conditions, as well as the timing of seasonal shifts in these habitats, have the potential to impact a wide range of listed aquatic species (Tillmann and Siemann 2011, Reeder et al. 2013).

The adaptive ability of these threatened and endangered species is depressed due to reductions in population size, habitat quantity and diversity, and loss of behavioral and genetic variation. Without these natural sources of resilience, systematic changes in local and regional climatic conditions due to anthropogenic global climate change will likely reduce long-term viability and sustainability of many populations (NWFSC 2015). New stressors generated by climate change, or existing stressors with effects that have been amplified by climate change, may also have synergistic impacts on species and ecosystems (Doney et al. 2012). These conditions will possibly intensify the climate change stressors inhibiting recovery of ESA-listed species in the future.

The terminology for species used for the PS steelhead listing is distinct population segment (DPS), which describes the "species" or "population" unit that is listed under the ESA. The PS steelhead DPS includes naturally spawned anadromous steelhead originating below natural and manmade impassable barriers from rivers flowing into Puget Sound from the Elwha River (inclusive) eastward, including rivers in Hood Canal, South Sound, North Sound and the Strait of Georgia, and steelhead from six artificial propagation programs.

A DPS can be viewed as complex population structure with processes operating at scales ranging from individual breeding aggregations to the entire DPS. Along this continuum, PS steelhead are grouped into three hierarchical units for defining attributes related to biological processes that

characterize DPS status, from smallest to largest: demographically independent populations (DIPs), major population groups (MPGs), and the entire DPS. Puget Sound steelhead have 32 constituent DIPs (or populations) within the three MPGs (Northern Cascades, Central and South Puget Sound, and Hood Canal and Strait of Juan de Fuca) that compose the Puget Sound DPS. (Myers et.al. 2015, NOAA Tech. Memo. NMFS-NWFSC-128). Table 1 below provides a summary of listing and recovery plan information, status summaries and limiting factors for the species addressed in this opinion. More information can be found in recovery plans and status reviews for these species. These documents are available on the NMFS West Coast Region website (<http://www.westcoast.fisheries.noaa.gov/>).

Recovery is defined under the ESA as an improvement in the status of listed species to the point at which listing is no longer appropriate under the criteria set out in section 4(a)(1) of the Act (50 CFR §402.02). The recovery of listed species is the cornerstone and ultimate purpose of the Endangered Species Program and an underlying premise for all recovery actions. It is the process by which listed species and their ecosystems are restored and their future is safeguarded to the point that protections under the Endangered Species Act are no longer needed. The recovery plan for PS steelhead is still in development, but it will likely will have similar goals as the PS Chinook recovery plan (SSPS 2007, NMFS 2006) of self-sustaining populations with abundance and productivity that support harvestable surplus. The recovery plan for PS Chinook salmon focuses largely on the amount, type, and location of freshwater habitat preservation and restoration needed to support recovery of the species. Recovery of many different salmonid species is also dependent on harvest and hatchery management, ocean conditions, hydro-electric dam management, and shoreline, estuarine, and water quality conditions.

### **2.2.1 Status of the Species**

Table 1 below provides a summary of listing and recovery plan information, status summaries and limiting factors for the species addressed in this opinion. More information can be found in recovery plans and status reviews for these species. These documents are available on the NMFS West Coast Region website (<http://www.westcoast.fisheries.noaa.gov/>).

**Table 1.** Listing classification and date, recovery plan reference, most recent status review, status summary, and limiting factors for each species considered in this opinion.

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Puget Sound Chinook salmon	Threatened 6/28/05	SSDC 2007  NMFS 2006	NWFSC 2015	This ESU comprises 22 populations distributed over five geographic areas. Most populations within the ESU have declined in abundance over the past 7 to 10 years, with widespread negative trends in natural-origin spawner abundance, and hatchery-origin spawners present in high fractions in most populations outside of the Skagit watershed. Escapement levels for all populations remain well below the TRT planning ranges for recovery, and most populations are consistently below the spawner-recruit levels identified by the TRT as consistent with recovery.	<ul style="list-style-type: none"> <li>• Degraded floodplain and in-river channel structure</li> <li>• Degraded estuarine conditions and loss of estuarine habitat</li> <li>• Degraded riparian areas and loss of in-river large woody debris</li> <li>• Excessive fine-grained sediment in spawning gravel</li> <li>• Degraded water quality and temperature</li> <li>• Degraded nearshore conditions</li> <li>• Impaired passage for migrating fish</li> <li>• Severely altered flow regime</li> </ul>
Puget Sound steelhead	Threatened 5/11/07	In development	NWFSC 2015	This DPS comprises 32 populations. The DPS is currently at very low viability, with most of the 32 populations and all three population groups at low viability. Information considered during the most recent status review indicates that the biological risks faced by the Puget Sound Steelhead DPS have not substantively changed since the listing in 2007, or since the 2011 status review. Furthermore, the Puget Sound Steelhead TRT recently concluded that the DPS was at very low viability, as were all three of its constituent MPGs, and many of its 32 populations. In the near term, the outlook for environmental conditions affecting Puget Sound steelhead is not optimistic. While harvest and hatchery production of steelhead in Puget Sound are currently at low levels and are not likely to increase substantially in the foreseeable future, some recent environmental trends not favorable to Puget Sound steelhead survival and production are expected to continue.	<ul style="list-style-type: none"> <li>• Continued destruction and modification of habitat</li> <li>• Widespread declines in adult abundance despite significant reductions in harvest</li> <li>• Threats to diversity posed by use of two hatchery steelhead stocks</li> <li>• Declining diversity in the DPS, including the uncertain but weak status of summer-run fish</li> <li>• A reduction in spatial structure</li> <li>• Reduced habitat quality</li> <li>• Urbanization</li> <li>• Dikes, hardening of banks with riprap, and channelization</li> </ul>

### *Puyallup River Steelhead Population*

Recent Status Review update for Pacific Salmon and Steelhead (NFSC 2015) indicates that the biological risks faced by the Puget Sound steelhead DPS have not substantively changed since the listing in 2007, or since the 2011 status review. Furthermore, the Puget Sound Steelhead Technical Review Team recently concluded that the DPS was at very low viability, as were all three of its constituent major population groups (MPGs), and many of its 32 demographically independent populations (DIPs) (Hard et al. 2015). In fact, within the Central and South Sound MPG every river's viability is low; the Puyallup is included in this list of 8 drainages (NWFSC 2015). The recovery plan for steelhead is under development. The specific contribution of Puyallup steelhead to the Puget Sound DPS for recovery has not been determined; however, for purposes of this analysis it is assumed that it is significant and that Puyallup steelhead must achieve viability for full recovery across the Puget Sound DPS.

Trends in abundance of natural spawners remain predominantly negative. Particular aspects of diversity and spatial structure, including limited use of suitable habitat, are still likely to be limiting viability of most Puget Sound steelhead populations. In the near term, the outlook for environmental conditions affecting Puget Sound steelhead is not optimistic. While harvest and hatchery production of steelhead in Puget Sound are currently at low levels and are not likely to increase substantially in the foreseeable future, some recent environmental trends not favorable to Puget Sound steelhead survival and production are expected to continue (NWFSC 2015).

**Life History.** Both steelhead and rainbow trout are present throughout the upper Puyallup River Watershed. The steelhead is the anadromous form of rainbow trout; offspring from either steelhead or rainbow trout can become anadromous, or remain in freshwater (resident form) their entire lives. In May of 2007, NMFS listed Puget Sound steelhead as "threatened" under ESA. 50 C.F.R. 223.102(e). This ESA protection covers naturally spawned steelhead, in addition to six hatchery stocks. However, the ESA protection does not pertain to rainbow trout. The presence of steelhead above Electron and within the project affected reach remains entirely natural. No enhancement of this species was ever undertaken and recovery has been left to natural forces.

The upper Puyallup steelhead population is a wild winter-run stock. Steelhead generally enter the river system beginning in December/January and continue through spring. Steelhead returning to the Upper Puyallup basin commence spawning as early as the beginning of March, and continue through June. Spawning ground data from Puyallup Tribal Fisheries shows peak spawning takes place in the upper Puyallup River basin from late April to early May; and in the lower river, peak spawning occurs typically in mid-late May (Marks 2016).

Steelhead spawners frequently use the mainstem Puyallup; although, the majority of spawning takes place in many of the associated tributaries. Along the Puyallup River, the upper reach tributaries of Kellogg, Niesson and LeDout creeks, support the majority of spawners. In addition, the roughly five miles of mainstem river channel below the Electron diversion dam (RM 41.7) consistently experiences a number of spawners as well.

From scales collected on steelhead smolts in the Puyallup River rotary screw trap, a majority of steelhead migrate as two year olds (59 percent), followed by one year olds (23 percent), three

year olds (15 percent) and four year olds (3 percent) (Berger et. al, 2015). Most steelhead smolt emigrate during high flow events in April and May. Scale data from 792 adult winter steelhead captured in the USACE trap from 1985 to 2004 show the majority of young wild winter steelhead migrate to saltwater after 2 years in freshwater (81.6 percent). Approximately 2.5 percent of the steelhead sampled spent 1 year in freshwater, 15.6 percent three-years, and less than 0.25 percent four-years before out-migrating. None of the steelhead sampled spent more than 4 years residing in freshwater. Nearly all hatchery reared steelhead, if grown to a large enough size (five fish-to-the-pound, or 90 grams each); will migrate to saltwater shortly upon release as yearlings (one-year-old plus fish). After spending between one and four years in saltwater; adult winter steelhead will return to the Puyallup/White system at three to seven years of age. Typically, most fish return after two to three years in saltwater as 4-year-olds (56 percent) and 5-year-olds (34 percent) (Marks 2016).

### *Puyallup River Chinook Population*

The Puyallup population of Chinook salmon is a significant contributor to the Puget Sound ESU. Five populations of Chinook salmon in the Puget Sound ESU, including the Puyallup, have experienced critically low returns within the last 20 years. This particular group of basins has had returns of less than 200 adult fish, placing these populations at substantial genetic and demographic risk. The Puyallup is within this group of rivers with population abundance and productivity at critical levels (NMFS 2007). The Puyallup population must be recovered from the current “high risk” status to “low risk” in order for the Puget Sound ESU to reach viability (NMFS 2006).

All PS Chinook salmon population abundances are well below escapement abundance levels identified as required for recovery to low extinction risk in the recovery plan. In addition, most populations are consistently below the productivity goals identified in the recovery plan as necessary for recovery. Although trends vary for individual populations across the ESU, most populations have declined in total natural origin recruit abundance since the last status review; and natural origin recruit escapement trends since 1995 are mostly stable. Several of the risk factors identified in the previous status review (Good, et al. 2005) are still present, including high fractions of hatchery fish in many populations and widespread loss and degradation of habitat.

Overall, the new information on abundance, productivity, spatial structure and diversity since the last review does not indicate a change in this ESU’s biological risk category. Over the last five years, the PS Chinook salmon ESU has made little progress toward meeting the recovery criteria and current trends in abundance are negative. However, available information does not indicate that extinction risk has increased significantly. Although this ESU’s total abundance is greatly reduced from historic levels, recent abundance levels do not indicate that the ESU is at immediate risk of extinction. This ESU remains relatively well distributed over 22 populations in 5 geographic areas across the Puget Sound. Although current trends are concerning, the available information indicates that this ESU remains at moderate risk of extinction (NMFS 2011).

***Life History.*** Adult Chinook were reintroduced to the Upper Puyallup River in 1999. Two distinct stocks of Chinook are present in the Puyallup River system. They include the White River Spring Chinook (*springer or spring-run*) and Puyallup River Fall Chinook (*fall or fall-*

run). Puyallup River Fall Chinook are endemic throughout the Puyallup River, Carbon River, Lower White River, plus many of the tributaries associated with these mainstem river systems. A large component of the adult fall spawners are hatchery origin from the WDFW Fall Chinook program operated on Voights Creek. In 2004, the Puyallup Tribe began operation of its own Fall Chinook hatchery (at river mile 1) on Clarks Creek, a tributary to the lower Puyallup River (RM 5.8). Genetic testing has shown similarities in both hatchery and wild Puyallup River Fall Chinook, with those of Chinook stocks found in several other watersheds within the Puget Sound region. The similarities are likely due to significant numbers of Fall Chinook imported to these watersheds from the Green River hatchery. Although Spring Chinook are known to spawn in the Puyallup River system, the straying rate is significantly less than that of Puyallup River origin Fall Chinook (Marks 2016).

Chinook production was started by two methods: 1) rearing hatchery produced fingerlings until smolt age and then providing for volitional release among natural acclimation ponds located on tributary streams above the project; and 2), transporting adult surplus Chinook from Voight Creek hatchery and allowing them to spawn naturally. Adults have been released at several locations over the years including the North Fork Puyallup, Deer Creek, two locations on Rushingwater Creek as well as the mainstem Mowich River. The latter method is responsible for producing unmarked progeny that are captured at the forebay trap.

Puyallup River fall-run Chinook adults enter the Lower Puyallup River in June, and continue to move through the system as late as November. The majority of tributary spawning activity occurs from September through late October, with the exception of some lower tributaries which often have fish present through early November. Initial spawning generally commences in the upper watershed; while the lower river and tributaries commonly experience active spawning beyond the time that live fish are even observed in the upper watershed. The age of adult Fall Chinook returning to spawn can range between two-to-five years of age. However, the largest components of adult returns are made up of four-year-olds; with a smaller proportion returning as three-year-olds. The 2012 season was the first year a significant escapement of naturally returning adult Chinook were observed spawning in the reach upstream of the Electron Project (*Rushingwater Creek*). Sampling data (*ventral fin clips*) showed many of the Chinook were survivors from juvenile Spring Chinook released from the Rushingwater ( $n=133,486$ ), or Cowskull ( $n=181,386$ ) acclimation ponds in 2009 (*2008 brood year*) (Marks 2016).

The majority of post emergent fry spend a moderate period of time residing instream before migrating to marine waters. Trapping data from a rotary screw trap in the lower Puyallup River showed that 99.5 percent ( $n=869$ ) of wild out-migrant Chinook caught were sub-yearlings (Berger et. al. 2015). Chinook emigration in the Puyallup begins as early as January and runs well into the last week of August, with the peak of migration taking place at the end of May. Berger et al. (2015), reported that sub-yearling Chinook sampled varied in length from 32-115mm during the trapping season (*January 30-July 26*), with significant size increases occurring throughout the season. The average fork length of Chinook measured from January through late July was 61mm; yet, the minimum size range did not exceed 50mm until after June 8th. Table 2 shows occupancy of the Puyallup River system by Puget Sound Chinook and Puget Sound steelhead life history stages by month in comparison with the in-water work window.



**Table 2.** Life history occupancy table of Puyallup River Populations of Puget Sound Chinook salmon and Puget Sound steelhead in the action area (adapted from Jeanes 2006).

Species/Life Stage	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
<b><u>Puget Sound Chinook</u></b>												
Upstream Migration								In-water work window				
Spawning												
Intergravel development												
Juvenile rearing												
Juvenile outmigration												
<b><u>Puget Sound Steelhead</u></b>												
Upstream Migration												
Spawning												
Intergravel development												
Juvenile rearing												
Juvenile outmigration												

### **2.2.2. Status of Critical Habitat**

This section describes the status of designated critical habitat affected by the proposed action by examining the condition and trends of the essential physical and biological features of that habitat throughout the designated areas. These features are essential to the conservation of the ESA-listed species because they support one or more of the species' life stages (*e.g.*, sites with conditions that support spawning, rearing, migration and foraging).

For most salmon and steelhead, NMFS's critical habitat analytical review teams (CHARTs) ranked watersheds within designated critical habitat at the scale of the fifth-field hydrologic unit code (HUC5) in terms of the conservation value they provide to each ESA-listed species that they support (NMFS 2005). The conservation rankings were high, medium, or low. To determine the conservation value of each watershed to species viability, the CHARTs evaluated the quantity and quality of habitat features, the relationship of the area compared to other areas within the species' range, and the significance to the species of the population occupying that area. Even if a location had poor habitat quality, it could be ranked with a high conservation value if it were essential due to factors such as limited availability, a unique contribution of the population it served, or is serving another important role.

Table 3 summarizes the status of critical habitats considered in this opinion.

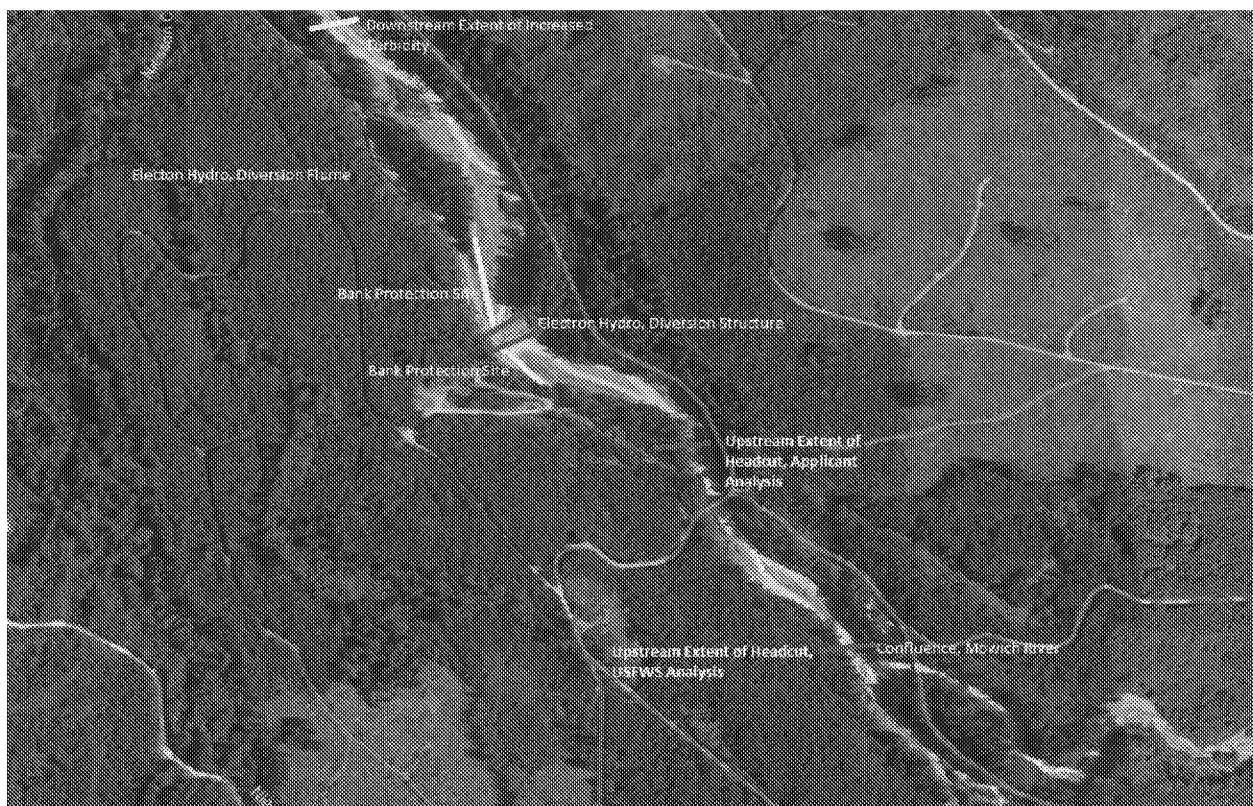
Table 3. Status of Critical Habitat

Species	Designation Date and Federal Register Citation	Critical Habitat Status Summary
Puget Sound Chinook salmon	9/02/05 70 FR 52630	Critical habitat for Puget Sound Chinook salmon includes 1,683 miles of streams, 41 square mile of lakes, and 2,182 miles of nearshore marine habitat in Puget Sounds. The Puget Sound Chinook salmon ESU has 61 freshwater and 19 marine areas within its range. Of the freshwater watersheds, 41 are rated high conservation value, 12 low conservation value, and eight received a medium rating. Of the marine areas, all 19 are ranked with high conservation value.
Puget Sound steelhead	2/24/16 81 FR 9252	Critical habitat for Puget Sound steelhead includes 2,031 stream miles. Nearshore and offshore marine waters were not designated for this species. There are 66 watersheds within the range of this DPS. Nine watersheds received a low conservation value rating, 16 received a medium rating, and 41 received a high rating to the DPS.

## 2.3 Action Area

“Action area” means all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02). In delineating the action area, we evaluated the farthest reaching physical, chemical, and biotic stressors across land, air, and water, over time, including direct and indirect pathways. Thus, the action area for this proposed federal action is based on the up- and downstream extent of the effects of the proposed action, including the cumulative effects from two years of operation of the diversion structure following construction.

The downstream extent of the action area is defined by the distance from the project site that increased turbidity from sediment suspended by the proposed action will attenuate to background levels. The upstream extent of the action area is defined by the length of the bank stabilization (300 feet) plus an additional 2700 feet to about the confluence of the Puyallup and Mowich Rivers. The 3000 feet upstream corresponds to the greatest possible extent of sediment headcutting that might arise during the first two years of bladder operations following construction. These distances are depicted in Figure 1, below. River flow direction in Figure 1 is from lower right to upper left.



**Figure 1.** The action area delineated upstream to the confluence with the Mowich River (red line, bottom right) and downstream based on the predicted extent of increased turbidity during construction (yellow line, top left).

## 2.4 Environmental Baseline

The “environmental baseline” includes the past and present impacts of all Federal, state, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of state or private actions which are contemporaneous with the consultation in process (50 CFR 402.02).

Electron Hydro LLC operates and maintains a hydroelectric power plant on the upper Puyallup River. The operation and maintenance of the hydroelectric power plant results in adverse effects to Puget Sound Chinook and Puget Sound steelhead. The upper Puyallup River originates from glaciers on the western slope of Mt. Rainier. Flows in the Puyallup River upstream of the action area are based on glacial melt, spring snowmelt and peak precipitation events. Extreme peak flows occur during winter months and generally result from rain on snow precipitation events. Spring snowmelt occurs from April through June and produces consistent moderate flows that vary with temperature and cloud cover. Glacial melt periods occur July through September and produce steady flows with sharply increased fine sediment loads. Low flows occur in early fall and during cold weather events throughout winter.

The action area is in the Upper Puyallup River subbasin. That subbasin starts downriver at the Electron Powerhouse at RM 31.2 and extends beyond the Electron Dam to the upper end of headwater tributaries. There are eleven tributaries accessible for anadromous fish within the subbasin that have the potential to produce Chinook and coho salmon, as well as steelhead and cutthroat trout (Kerwin 1999). Landownership within the subbasin is primarily private forest landowners and the USFS. The upper most headwaters draining Mt. Rainier are managed by the National Park Service. Logging activities peaked from the early-1950s through the late-1970s. Currently there are intensively managed private forestlands where logging activities are focused on second growth timber stands around 35 to 40 years-old. Since 2006, forest practices including logging have been governed by the Forest Practices Habitat Conservation Plan. NMFS consulted on the plan and issued an Incidental Take Permit in June 2006 (NMFS Tracking No. NWR-2005-7225 and Permit Number 1573).

The Electron Hydro diversion structure was constructed in 1904. The diversion structure blocked all fish passage until 2000 when a concrete pool and weir type fish ladder was constructed. The ladder requires at least 10 cfs to function properly, and it provides passage over the design flow range from 10 to 55 cfs. This range of flows through the ladder corresponds to river flows ranging from 160 to 1,100 cfs.

The headworks diverts water from the Puyallup River into a 10-mile long flume for electricity production. The diversion structure presently entrains fish a large amount of sediment. The system includes a two rock chutes to remove entrained rocks and cobbles near the intake. Sand and silt are removed half way down the flume in a settling basin, but entrained fish transit the entire length of the flume to a man made forebay in which water is stored before entering penstocks that provide flow to the powerhouse on the banks of the Puyallup River below..

Electron Hydro diverts up to 400 cfs of water from the Puyallup River, reducing instream flows by up to 70 percent in late fall and winter, and over 50 percent during the summer. In spring and early fall, water withdrawals can remove up to 90 percent. Minimum flows within the bypass reach (diversion dam to powerhouse) are 80 cfs from July 15 through November 15 and 60 cfs the rest of the year. Diversion of water by the Electron hydro facility reduce spawning habitat for PS Chinook salmon and PS steelhead within the 10 miles of the Puyallup River from the diversion dam to the powerhouse (the “bypass reach”) where flows return to the river. The available habitat for spawning may be in portions of the river that will easily scour or become too deep for eggs and alevins to survive during high flow events. Redds may also become dry if some spawning occurs when flows are high and then flows retreat and water is diverted.

Electron Hydro operates a trap-and-haul facility at the forebay to pass entrained fish from the forebay to the Puyallup River, and avoid killing them in the powerhouse. The Trap and Haul system operates by way of a lead-line net crossing the forebay and directing fish as they exit the flume to the trap. Captured fish are loaded into a truck and transport downstream to the Puyallup River at RM 31.2 where water from the powerhouse re-enters the river. Fish are also caught with hook and line within the forebay to be transferred downstream.

The action area includes critical habitat for PS Chinook salmon and steelhead. Within these areas, the primary biological features (PBFs) (referred to as “primary constituent elements” (PCEs) when NMFS designated critical habitat) essential for the conservation of these ESUs are those sites and habitat components that support one or more life stages. The terms PCEs and PBFs are used interchangeably in the rest of the opinion. The PBFs of critical habitat in the action area include 1) Freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning, incubation and larval development; 2) Freshwater rearing sites with: i) Water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility; ii) Water quality and forage supporting juvenile development; and iii) Natural cover such as shade, submerged and overhanging large wood, log jams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks; and 3) Freshwater migration corridors free of obstruction and excessive predation with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks supporting juvenile and adult mobility and survival.

The Fish habitat in the action area is lacking with most of the river consisting of riffles with short segments of boulder cascades. The water diversion mentioned above affects water quantity, an essential element of each of the three freshwater PBFs in the action area. Sediment bedload and suspended sediment loads are naturally high in the river, particularly in late spring through early fall when snow and glacier melt are at their highest (Czuba et.al. 2010) affecting substrate which is an essential feature of both the freshwater spawning and freshwater rearing PBFs. The action area also lacks woody material function to form cover and other physical habitat features at moderate to low flow conditions immediately downstream of the diversion dam. Instead, wood in the system is mobilized by high flows and deposited on gravel bars and perch along the riverbank. Finally, as the diversion presently entrains large numbers of migrating smolts, the action area presently functions poorly as a largely obstructed migration corridor. The trap and

haul operation in the project forebay operates to minimize the effects of the entrainment, but this PBF is otherwise poorly functioning in the action area.

## **2.5 Effects of the Action**

Under the ESA, “effects of the action” means the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline (50 CFR 402.02). Indirect effects are those that are caused by the proposed action and are later in time, but still are reasonably certain to occur.

The project involves replacing approximately 70 feet of a 200-foot-long diversion dam. The new diversion dam would consist of an inflatable rubber bladder on a concrete foundation. The project area would be isolated and dewatered twice; once on each side of the river. The primary construction-related effects of the proposed action on ESA-listed salmonids are: 1) injury or death from exposure to changes in water quality from increased turbidity and suspended sediment, and 2) injury or death during worksite isolation, and 3) injury or death from capture and handling after worksite isolation.

### **2.5.1 Effects on Listed Species**

#### *Water Quality--Suspended Sediment and Increased Turbidity*

The proposed action includes a series of activities that will suspended solid sediment in and around the project site during inwater work. Suspended sediment increases turbidity and decreases water quality to an extent that adversely affects listed salmonids. Although sediment bedload and suspended sediment loads are naturally high in the river (Czuba et.al. 2010), the proposed action will decrease water quality below background level to an extent that will change normal salmonid behavior in the action area. As a result, the proposed action is reasonably likely to injure or kill some individuals exposed to decreased water during the time it takes for water quality to return to background levels.

Isolating the worksites from the river prior to inwater work will cause a temporary increase in turbidity. Undoing the worksite isolation and reintroducing flow to formerly isolated inwater areas will cause another pulse of increased turbidity. The mechanism of these increases will be from installing supersacks and building the berms to isolate the worksites, and again when the applicant removes supersacks and the berms to reintroduce flow to isolated areas after the diversion replacement is complete.

To minimize the pulse of turbidity while rewatering the formerly isolated worksites, the applicant will slowly reintroduce flow to allow minimize suspension of suspended solids downstream. Despite the best efforts of the applicant, rewatering will likely produce sufficient turbidity and suspended sediments to lead to the effects described below. To ensure increased turbidity does not exceed expected amounts, the applicant will monitor water quality according to the monitoring plan described in Section 1.3. The extent of increased turbidity could be detectable as far as one half-mile downriver of the diversion (Figure 1).

Fish exposed to water in which increased turbidity exceeds normal background levels respond variously to that exposure. At various life stages, the effects of excessive sediment to salmon and steelhead can be fatal. Embryo survival and subsequent fry emergence success have been highly correlated to percentage of fine material within the streambed (Shepard et al. 1984), so action timing is constrained to avoid the time of year when incubating redds would be exposed to increased suspended sediment.

Low levels of sediment can injure fish that adjust normal behaviors in response to exposure. Changed normal behaviors include increased activity, stress, and increased energy expressed to avoid adversely affected areas. Changed behavior also includes lost or reduced foraging capability and leads to reduced growth and resistance to disease, and interference with orientation in homing and migration. Physical injury is also possible in the form of abrasion and gill clogging. (Barrett et al. 1992; Bash et al. 2001; Berry et al. 2003; Lake and Hinch 1999; McLeay et al. 1987; Newcombe and MacDonald 1991; Vondracek et al. 2003; Watts et al. 2003). The effects of increased suspended sediments can cause changes in the abundance and type of food organisms, alterations in fish habitat, and long-term impacts to fish populations (Anderson et al. 1996; Reid and Anderson 1999) although the action is not likely to change conditions for long enough to cause these larger issues. No threshold has been determined in which fine-sediment addition to a stream is harmless (Suttle et al. 2004, p. 973). Even at low concentrations, fine-sediment deposition can decrease growth and survival of juvenile salmonids.

To assess the suspended sediment concentrations at which adverse effects would occur, and to determine the downstream extent to which those effects may extend as a result of the proposed project, we rely on the findings of Newcombe and Jensen (1996) to evaluate the “severity-of-effect” based on suspended sediment concentration, exposure, and duration. Factors influencing suspended sediment concentration, exposure, and duration include waterbody size, volume of flow, the nature of the construction activity, construction methods, erosion controls, and substrate and sediment particle size. Factors influencing the severity-of-effect include duration and frequency of exposure, concentration, and life stage. Availability and access to refugia are other important considerations.

The framework requires an estimate of suspended sediment concentration (in milligrams per liter [mg/L] or Nephelometric Turbidity Units [NTUs]) and exposure duration. Turbidity in the Puyallup River can be extremely variable throughout the year because of the glaciers in which the river originates. Monitoring data collection on the Puyallup River near Orting (Station No. 10A110, located approximately 20 miles downstream) were used to determine the ratio of turbidity to suspended solids for the waterbody (1 NTU:2.6 mg/L). NMFS anticipates that any measurable increases in turbidity would be short-term and episodic.

Using this approach, we expect that adverse effects on adult, sub-adult, and juvenile salmonids are likely to occur under the following circumstances:

- When background NTU levels are exceeded by 56 NTU at any time.
- When background NTU levels are exceeded by 37 NTU for more than 1 hour, continuously.

- When background NTU levels are exceeded by 15 NTU for more than 3 hours, cumulatively, over a 10-hour workday.
- When background NTU levels are exceeded by 8 NTU for more than 7 hours, cumulatively, over a 10-hour workday.

Because of the location of the project site, Electron Hydro has limited access to the river. Water quality monitoring would occur upstream of the project site and approximately 1,500 feet downstream. The proposed action could increase turbidity as far as ½ mile downstream of the project site and water quality monitoring within 1500 feet of the diversion will inform the applicant as to whether that extent would be exceeded during activities that increase turbidity.

Juvenile, sub-adult, and adult salmonids may occupy the waters surrounding the project area at any time of year. Sub-adult and adults are less likely to be affected by episodic increases in turbidity and suspended sediments during construction, but may exhibit a behavioral response (likely temporary avoidance of turbid areas). Sediment bedload and suspended sediment loads are naturally high in the river, particularly in late spring through early fall when snow and glacier melt are at their highest (Czuba et.al. 2010). Some salmonids would avoid the area when suspended sediment concentrations are elevated beyond natural conditions. Resulting turbidities may also impede or discourage free movement through the action area, delaying or discouraging adults from migrating through and around the project area. However, fish would not be exposed to elevated turbidities outside daylight (working) hours; therefore, nocturnal movements and migration through and around the project area would be unimpeded during certain times of the day. Further, in-water work with excavating of bedload material in the active channel would require a maximum of seven days and would be completed between July 15 and September 15 to limit exposure of ESA-listed fish.

Although using the best available information, NMFS cannot possibly estimate the number of individual fish that would be adversely affected by decreased water quality, we do know that these populations of salmonids evolved in a system characterized by naturally high sediment levels. Furthermore, the applicant proposes to constrain in-water work to daylight hours over a 7-day period during a time of year when the fewest fish of the most vulnerable life stage would be exposed. Therefore, it is likely that only a few individual salmonids are likely to be injured or killed by decreased water quality.

#### *Worksite Isolation*

As mentioned above, the applicant proposes to isolate the worksite to complete inwater work in the proposed action. Worksite isolation and flow diversion are typical measures incorporated into actions with inwater construction elements to reduce exposure of fish to construction activities. After isolating worksites, but before removing water from the isolated sites, such actions also typically include fish capture and handling elements to reduce the risk of fish stranding when contractor dewater isolated worksites. Although these measures are often included for projects with inwater work, these activities themselves can injure or kill individual fish. The applicant will follow the worksite isolation and fish exclusion protocols described in Appendix A to this opinion.



As described above, the applicant intends to place supersacks and build berms to isolate worksites. Salmonids may be crushed or injured during the placement of the supersacks, sediment berms, or other features in the wetted width of the waterbody during isolation of the work area. The project area is used by juvenile, sub-adults, and adults throughout the year as foraging, migration, and overwintering habitat. Juveniles are more at risk of being injured or killed because they seek refuge in the substrate instead of swimming away. Because the larger life history stages are mobile and can easily respond to in-water activities, it is extremely unlikely that larger sub-adults or adults would be affected during the placement of the supersacks, sediment berms, or other features in the river.

We anticipate that the number of small (e.g., greater than 100 mm) juvenile and sub-adults that may be killed or injured during the placement of the supersacks, sediment berms, or other features to isolate the project site is low. Predicting the number of individual fish that could be exposed and thus injured or killed by this activity is impossible. However, the applicant proposes to isolate an area of approximately 30,000 square feet area (1,000 feet by 30 feet) using a cofferdam composed of supersacks and sediment berms during in-water construction from July 15 to September 15, 2018. Although the likelihood of injury or death from crushing during the construction of the proposed cofferdam is low, we anticipate that some number of juvenile fish in the action area could be crushed or otherwise injured during placement of the supersacks and other features during river isolation activities.

#### *Effects of Capture and Handling*

As mentioned above, the applicant will comply with the process for excluding fish from the isolated work area during in-water work. Fish exclusion, capture, and handling are included as measures to reduce the number of individual fish that would be exposed to in-water work. NMFS has reviewed this process and expects these protocols to be effective so that nearly all of the exposed individual fish would experience no long-term effects. The process for exclusion begins with less intrusive methods of handling fish including herding the isolated area with block nets, seining, and dip netting by a qualified biologist.

Electrofishing is used as a last resort after a qualified biologist determines that all or nearly all of the sub-adult and adult-sized fish have been effectively removed. Only biologists trained by qualified personnel and familiar with equipment handling, settings, maintenance, and safety may operate electrofishing equipment. Capture operations that utilize electrofishing equipment shall use the minimum voltage, pulse width, and rate settings necessary to immobilize fish, and shall measure water conductivity in the field before electrofishing in order to determine appropriate settings.

Electrofishing can more severely affect adult salmonids because of their larger size and surface area. Injuries, which may cause or contribute to delayed mortality, can include spinal hemorrhages, internal hemorrhages, fractured vertebra, spinal misalignment, and separated spinal columns (Dalbey et al. 1996; Hollender and Carline 1994; Thompson et al. 1997a). Sharber and Carothers (1988) report that electrofishing killed 50 percent of the adult rainbow trout in their

study. The long-term effects of electrofishing on juvenile and adult salmonids are not well understood, but long experience with electrofishing indicates that most measurable effects occur at the time of fish capture operations and are of relatively short duration.

Applying best professional judgment, NMFS cannot possibly estimate the number of fish that would be exposed to capture and handling, or injury or death from electrofishing. As such, the extent of habitat modified by worksite isolation will serve as a surrogate to estimate the extent of possible effects. That area corresponds to the 30000 square feet estimated for worksite isolation.

### **2.5.2 Effects on Critical Habitat**

The action area includes critical habitat for PS Chinook salmon and PS steelhead. Within these areas, the PBFs essential for the conservation of these ESUs are those sites and habitat components that support one or more life stages. The PBFs of critical habitat in the action area include 1) Freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning, incubation and larval development; 2) Freshwater rearing sites with: i) Water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility; ii) Water quality and forage supporting juvenile development; and iii) Natural cover such as shade, submerged and overhanging large wood, log jams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks; and 3) Freshwater migration corridors free of obstruction and excessive predation with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks supporting juvenile and adult mobility and survival.

The proposed action will decrease water quality as described above in section 2.5.1, adversely affecting the water quality element of all three freshwater PBFs of critical habitat present in the action area (freshwater spawning, freshwater rearing, and migration corridors). Although the river is naturally high in sediment and bedload, the action will suspend sediment causing a plume that could extend as far as ½ mile downriver of the project. This plume will be present for short periods of time during and following the worksite isolation process, and again when the applicant undoes the supersack berms reintroducing flow into formerly isolated areas.

As also described above, the temporal extent of water quality changes will be limited and only present during the time of year to which inwater work is constrained by the proposed action. Furthermore, the applicant commits to conducting inwater work during only a short portion of this period, furthermore diminishing the importance of this effect. NMFS expects river conditions to return to background levels within days of completing inwater work and that effects on water quality will not bear on the conservation role of the PBFs in the action area thereafter.

In addition to water quality, the act of isolating the worksite will divert some river flow around the isolated portion of the river. This will change the local pattern of downstream flow in the immediate area of the project footprint, possibly altering the migration corridor. The right side of the river would be dewatered first to allow a liner to be placed on top of the existing diversion.

After the applicant installs the liner, they will divert flows to the right side of the river to allow replacement of the diversion with the rubber bladder. Diverting flow to the left side of the river will prevent operation of the fish ladder, impeding upstream passage for a maximum of one working day (16 hours), when a temporary berm is constructed and channel is configured. The action area would be open to unobstructed upstream migration through the fish ladder for all of the 3.5 month run timing of PS Chinook salmon. As such, the loss of about 16 hours at some time between late-July through October, will not alter the conservation role of the migration corridor PBF of critical habitat in the action area.

## **2.6 Cumulative Effects**

“Cumulative effects” are those effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation (50 CFR 402.02). Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

Future state and private actions reasonably certain to influence conditions in action area include forest practices and two years of bladder operation until the applicant is able to complete an application for an ESA section 10(a)(1)(B) incidental take permit. Forest practice in Washington are regulated under the State Forest Practice Act (RCW, 76.09) and Forest Practices Rules (Title 222 WAC). NMFS reviewed those practices under the Washington Forest Practices Habitat Conservation Plan when it approved an application and issued the State of Washington an ESA section 10(a)(1)(B) incidental take permit (ITP) covering the State’s Forest Practices program. As part of the process of issuing the Forest Practices ITP, NMFS conducted intra-agency ESA section 7 consultation and found that the issuing the permit would not jeopardize a large suite of salmonids, including PS steelhead and PS Chinook salmon. Therefore, we do not revisit those effects in this analysis.

Electron Hydro is also in the process of developing an HCP with NMFS and USFWS as part of an application for an ITP to cover operation and maintenance of the Electron Hydro system for the foreseeable future. Because the COE has no jurisdiction over these future private actions, they are not addressed in this consultation, leading to the need for an HCP. However, because NMFS cannot be sure of the date that HCP process will be complete, we are reviewing the effects of two years of bladder operation as cumulative effects in this opinion.

For the time between completion of the proposed action and installation of fish exclusion screens in the diversion, the system will continue to entrain fish, requiring continuing operation of the trap and haul operation at the Forebay. A limited number of entrained fish leave the flume and re-enter the Puyallup River bypass reach (below the diversion) at rock chutes built into the flume. The rest are shunted down the flume to the forebay where they are removed and replaced in the river by a trap and haul system Electron Hydro operates per the 1998 REA. The forthcoming HCP will include commitments to install criteria fish screens at the diversion, ending the entrainment of fish at the diversion.

In addition to entrainment of fish at the diversion, operating the bladder will interact with the cyclical bedload sediment movement through the system from above the diversion structure. Electron Hydro conducted a Geomorphology and Sediment Transport Study (Cherry 2016) to assess the extent to which bladder operations would affect channel sediments above the diversion.

The proposed bladder spillway would maintain a pool elevation at 1620.70 by adjusting the degree of inflation in response to changes in flow. As flows increase, the bladder is slightly deflated to pass the increased flow. Continuous operation of the bladder to maintain a steady pool elevation would minimize the effects of the diversion on bedload sediment transport. Bedload would pass over the dam in proportion to the amount of flow in the river. The effect of the bladder on temporary sediment storage upstream would be highest when Electron Hydro fully inflates the bladder and lowest when Electron Hydro fully deflates the bladder. Generally, Electron Hydro would vary bladder inflation with flow to closely mimic the natural transport of bedload with river flow.

Deflating the bladder at high flow and lowering the controlling bed elevation from the existing 3 feet to the proposed 12 feet would result in an immediate and rapid response as bed scour or “headcut” in the immediate vicinity of the diversion. Over time, the scour would progress upstream and the effective bed slope (and related water surface slope) would get progressively flatter. The rate of bed scour slows down as it progresses upstream. According to Cherry 2016, this scour could progress as far as 800 feet upstream of the diversion structure (Figure 2).



**Figure 2.** Upstream Sediment Unravel Zone, Cherry 2016.

The headcut results from the difference in river elevation above and below the diversion dam. The 12 foot difference in elevation would migrate upstream until either the headcut hits a hard surface, like a bedrock outcrop, or a gradient change in the river results in the headcutting stopping its upstream migration. Electron Hydro estimates the headcut would migrate upstream approximately 800 feet. USFWS conducted a rough analysis based on topography maps and calculated the headcut may migrate as far as the confluence with the Mowich River, 3000 feet upriver from the diversion (Bakke 2018). We take this assessment to be the worst case scenario.

The headcut would occur, most often, in the fall and winter during the highest flows of the year. This time of year could coincide with incubating upstream redds between the diversion and the confluence with the Mowich River. The Puyallup Tribe regularly surveys for steelhead redds up- and downstream of the diversion and notes extensive steelhead spawning in Ledout, Kellog, and Niesson Creeks (Ladley, Pers. Comm. 6/2018). Each are tributaries to the Puyallup, downriver of the action area and would be unaffected by the headcut. In contrast, although the river upstream of the diversion has some structure and gravels that would support spawning, surveys reveal little spawning activity in the mainstem Puyallup River upstream of the diversion until reaching tributaries of the Mowich River (Ladley, Pers. Comm. 6/2018). The planned HCP would include measures to minimize the effects of operations on redds in the action area.

Until the development of the HCP for the operation and maintenance activities of the Electron hydroelectric facility, the adverse effects associated with these activities, which are not covered by this consultation, would continue with no mitigation, conservation measures, or measures implemented to avoid, reduce, or minimize the adverse effects. Since the COE has no discretion to address these effects in the proposed permit, they are not addressed in the incidental take statement that accompanies this opinion.

## **2.7 Integration and Synthesis**

The Integration and Synthesis section is the final step in our assessment of the risk posed to species and critical habitat as a result of implementing the proposed action. In this section, we add the effects of the action (Section 2.5) to the environmental baseline (Section 2.4) and the cumulative effects (Section 2.6), taking into account the status of the species and critical habitat (Section 2.2), to formulate the agency's biological opinion as to whether the proposed action is likely to: (1) Reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing its numbers, reproduction, or distribution; or (2) appreciably diminishes the value of designated or proposed critical habitat for the conservation of the species.

Electron Hydro, LLC proposes to replace 70 feet of the diversion structure with an air inflated rubber bladder to reduce sediment input into their intake structure. In addition, a trash rack would be added to the intake structure and bank protection along the left bank would be reinforced. The project involves isolating the right side of the river to install a lining over the diversion dam to reduce water leaking into the work area when the left side of the river is diverted to replace the diversion dam. In-water work with excavating of bedload material in the active channel would be completed between July 15 and September 15 to limit exposure of ESA-

listed fish to increased turbidity and the effects of worksite isolation and fish capture and handling.

Under the baseline, fish entrainment by the diversion structure is the most notable impediment to downstream fish passage in the action area. Entrainment, and thus reliance on trap and haul to reduce effects of entrainment would continue into the future until Electron Hydro completes its HCP and installs fish screens at the diversion.

The proposed action would injure or kill a very limited number of fish comprising populations of the PS steelhead DPS and PS Chinook salmon ESU. These effects would be the result of adverse response to exposure to increased turbidity, worksite isolation, or during capture and handling included in the action to minimize the number of fish exposed to increased turbidity and worksite isolation. Furthermore, the action constrains the timing of in-water work to limit the exposure of the most vulnerable life stages in the action area, but cannot completely avoid exposure and some exposed fish will be injured or die.

Under cumulative effects, NMFS found that fish entrainment would continue between completion of the proposed action and beginning of operations under a planned HCP. This effects requires continued operation of the forebay trap and haul system which returns between 85 and 95 percent of entrained fish to the river, until Electron Hydro installs fish screens at the diversion. In addition, cyclical operation of the bladder dam to mimic normal river flow through the action area would cause periodic headcutting upstream of diversion from between 800 and 3000 feet under the worst case. Although this could adversely affect redd function upstream of the diversion, little or no spawning activity has been seen in surveys of the reach by the Puyallup Tribe.

Water quality and headcutting bear on critical habitat. Water quality is an essential element of the freshwater spawning, rearing, and migration PBFs of critical habitat designated for PS Chinook salmon and steelhead. Despite the fact that increased turbidity can adversely influence the role of critical habitat at the site scale, the turbidity in this action would be short-lived and quickly diluted by normal flows in the action area. In addition, substrate is an essential element of the spawning PBF. Cyclical headcutting above the diversion would perpetuate instability of the substrate in the reach between the diversion and the confluence, especially in the first 800 feet above the diversion until completion and implementation of the proposed HCP.

Beyond the action area, effects of the action individual fish would be too small to influence on local fish population variables including abundance and productivity. Abundance and productivity would remain limited by conditions in the action area that are more limiting than any aspect of the effects of the action on the affected populations PS steelhead and PS Chinook salmon. Climate change would likely continue to be a factor in recovery of the two species, causing continued negative pressure on spawning and rearing habitat. As such, the repairs essentially maintain the status quo in the action area for PS Chinook salmon and PS steelhead in terms of population trends, abundance, and productivity in the watershed in which the action would take place. Accordingly, the action is not likely exacerbate the risk of extinction of PS Chinook salmon and PS steelhead.

Similarly, temporary changes in water quality in the action area would not influence water quality at the watershed scale. As such, these effects would not bear on the conservation role of the Upper Puyallup River watershed on critical habitat designated for PS Chinook salmon and PS steelhead.

## **2.8 Conclusion**

After reviewing and analyzing the current status of the listed species and critical habitat, the environmental baseline within the action area, the effects of the proposed action, any effects of interrelated and interdependent activities, and cumulative effects, it is NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence of Puget Sound Chinook and Puget Sound steelhead or destroy or adversely modify its designated critical habitat.

## **2.9 Incidental Take Statement**

Section 9 of the ESA and Federal regulations pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. "Harm" is further defined by regulation to include significant habitat modification or degradation that actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding, or sheltering (50 CFR 222.102). "Incidental take" is defined by regulation as takings that result from, but are not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or applicant (50 CFR 402.02). Section 7(b)(4) and section 7(o)(2) provide that taking that is incidental to an otherwise lawful agency action is not considered to be prohibited taking under the ESA if that action is performed in compliance with the terms and conditions of this ITS.

### **2.9.1 Amount or Extent of Take**

During consultation, NMFS found that the proposed action would cause take of listed PS Chinook salmon and PS steelhead. Take would occur in the form of harm from habitat modification resulting from increase turbidity; harm from habitat modification in the form of worksite isolation, and harm from capture and handling individual fish during minimization efforts.

1. Take in the form of harm from habitat modified by elevated turbidity: Take would occur during in-water work. The number of individual fish injured or killed is impossible to determine using the best available information. In situations where the number of animals taken cannot be estimated, NMFS relies on a surrogate measure of incidental take in the form of the extent of spatial measures of habitat modified. For this action, the applicant estimates that short term increases of turbidity will be detectable as far downstream as ½ mile from the point of in water work. This surrogate measure of take can be reasonably and reliably monitored by the applicant testing water quality approximately 1500 feet downstream of the project site.



2. Take in the form of harm during worksite isolation from the construction of cofferdams and with supersacks and sediment berms. Even using the best available information, estimating the number of individual fish injured or killed by isolation from the worksite is not practical. Therefore, NMFS again relies on a surrogate measure of incidental take in the form of the extent of spatial measure of the isolated portion of the worksite. The isolated worksite will be approximately 30,000 square feet and limited to the period of time between July 15 and September 15, 2018. The extent of the worksite can be reliably monitored because it is physically measurable.
3. Take in the form of capture during fish exclusion from the isolated worksite. Although worksite isolation using the protocol described in Appendix A should all but clear the site of residual fish, the possibility remains that some number of fish will remain and be exposed to netting, electrofishing, capture and handling during replacement in the flowing portion of the river. NMFS estimates that that no more than 10 PS Chinook salmon and no more than two PS steelhead combined would be captured and handled during work area isolation.

### **2.9.2 Effect of the Take**

In the biological opinion, NMFS determined that the amount or extent of anticipated take, coupled with other effects of the proposed action, is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat.

### **2.9.3 Reasonable and Prudent Measures**

“Reasonable and prudent measures” are nondiscretionary measures that are necessary or appropriate to minimize the impact of the amount or extent of incidental take (50 CFR 402.02).

The project incorporates design elements and conservation measures that we expect would reduce permanent effects to habitat and avoid and minimize impacts during construction. We expect that the Corps would fully implement these measures, and therefore they have not been specifically identified as reasonable and prudent measures (RPMs) or terms and conditions.

NMFS believes the following RPMs are necessary and appropriate to minimize the impacts (i.e., the amount or extent) of incidental take of Puget Sound steelhead and Puget Sound Chinook:

1. Minimize incidental take of Puget Sound Chinook and Puget Sound steelhead caused by elevated turbidity during construction.
2. Minimize incidental take from worksite isolation.
3. Minimize incidental take from capture and handling.
4. Implement monitoring and reporting to confirm that the take exemption for the proposed action is not exceeded.

#### **2.9.4 Terms and Conditions**

The terms and conditions described below are non-discretionary, and the Corps or any applicant must comply with them in order to implement the RPMs (50 CFR 402.14). The Corps or any applicant has a continuing duty to monitor the impacts of incidental take and must report the progress of the action and its impact on the species as specified in this ITS (50 CFR 402.14). If the entity to whom a term and condition is directed does not comply with the following terms and conditions, protective coverage for the proposed action would likely lapse.

1. To implement Reasonable and Prudent Measure 1, the Corps shall ensure that:

- a. Monitoring will be conducted to establish background turbidity levels upstream of construction and away from the influence of sediment-generating activities. Background turbidity will be monitored at least twice daily during sediment-generating activities. In the event of a visually appreciable change in background turbidity, an additional sample will be taken.
- b. Turbidity monitoring will be conducted at a distance of 1,500 feet downstream of in-water construction activities.
- c. Monitoring will be conducted at 30-minute intervals for the first 3 hours from the start of sediment-generating activities. If the background NTU levels are exceeded by the following levels, then the amount of take authorized by the Incidental Take Statement will have been exceeded and sediment-generating activities will cease.
  1. If background NTU levels are exceeded by 56 NTU at any time.
  2. If background NTU levels are exceeded by 37 NTU for more than 1 hour cumulatively over a 10-hour workday.
  3. If background NTU levels are exceeded by 13 NTU for more than 3 hours cumulatively over a 10-hour workday.
  4. If background NTU levels are exceeded by 8 NTU for more than 7 hours cumulatively over a 10-hour workday.
- d. If turbidity levels approach the above-listed NTU values, work will cease and the sediment control procedures will be reevaluated. Sediment and erosion control measure shall be modified to reduce turbidity levels. The Corps will contact the Service's consulting biologist to discuss means of assuring that the authorized amount of incidental take is not exceeded.
- e. If levels of turbidity do not exceed the above levels during the first hour, then monitoring may be reduced to once every hour during sediment-generating activities.
- f. If, in cooperation with other permit authorities, the Corps develops a functionally equivalent monitoring strategy (e.g., intensive monitoring by project area or activity, followed by validation and routine monitoring), they may submit this plan to the NMFS for review and approval in lieu of the above monitoring requirements. This

strategy must be submitted to NMFS a minimum of 60 days prior to construction. In order to be approved for use in lieu of the above requirements, the plan must meet each of the same objectives.

2. To implement reasonable and prudent measure 2, the COE shall ensure that:
  - a. The NMFS is to be notified when constructions starts.
  - b. Personnel conducting fish exclusion will have the necessary training, knowledge, skills and abilities to ensure the safe handling of all ESA listed fish.
  - c. Fish exclusion is to be conducted only by or under the direct supervision of a trained and experienced fishery biologist.
  - d. Personnel will regularly check block nets for impinged or dead fish.
3. To implement reasonable and prudent measure 3, the COE shall ensure that:
  - a. The applicant abides by the protocol for fish capture and handling described in Appendix A.
  - b. The applicant reports on all fish captured and handled as required in Appendix A.
4. To implement reasonable and prudent measure 4, the Corps will ensure that:
  - a. The amount and extent of take is monitored by preparing a report identifying any incidental take associated with project activities and describing conservation measures implemented to minimize take. The report shall include a description of construction activities conducted, the duration of all construction activities, conservation measures implemented, and the following:
    - i. Results of surface water quality monitoring (focused on turbidity and suspended sediments) required during construction. Data shall include, at a minimum, the following: 1) dates, times, and locations of construction activities; 2) monitoring results, sample times, locations, and measured turbidities (in NTUs; 3) a summary of construction activities and measured turbidities associated with those activities; and 4) a summary of corrective actions taken to reduce turbidity.
    - ii. Dates and description of construction related activities such as 1) installation and removal of the in-water cofferdams; 2) means or methods of fish capture used; 3) species and number of fish captured; and 4) if electrofishing is used, provide settings and estimated duration of use.
    - iii. The report shall be submitted to the NMFS office in Seattle, Washington, by December 31 of the year during which construction took place.

## **2.10 Conservation Recommendations**

Section 7(a)(1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. Specifically, conservation recommendations are suggestions regarding discretionary measures to minimize or avoid adverse effects of a proposed action on listed species or critical habitat or regarding the development of information (50 CFR 402.02).

1. Electron Hydro LLC should immediately develop an HCP to address adverse effects and unauthorized take associated with the operation and maintenance of the hydroelectric generating facility.

## **2.11 Reinitiation of Consultation**

This concludes formal consultation for the Electron Hydro Phase I Diversion Repair, Spillway Replacement, and Bank Protection.

As 50 CFR 402.16 states, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained or is authorized by law and if: (1) The amount or extent of incidental taking specified in the ITS is exceeded, (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion, (3) the agency action is subsequently modified in a manner that causes an effect on the listed species or critical habitat that was not considered in this opinion, or (4) a new species is listed or critical habitat designated that may be affected by the action.

## **3. MAGNUSON-STEVENSON FISHERY CONSERVATION AND MANAGEMENT ACT ESSENTIAL FISH HABITAT RESPONSE**

Section 305(b) of the MSA directs Federal agencies to consult with NMFS on all actions or proposed actions that may adversely affect EFH. The MSA (section 3) defines EFH as “those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity.” Adverse effect means any impact that reduces quality or quantity of EFH, and may include direct or indirect physical, chemical, or biological alteration of the waters or substrate and loss of (or injury to) benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality or quantity of EFH. Adverse effects on EFH may result from actions occurring within EFH or outside of it and may include site-specific or EFH-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810). Section 305(b) also requires NMFS to recommend measures that can be taken by the action agency to conserve EFH.

This analysis is based, in part, on the EFH assessment provided by NMFS and descriptions of EFH for Pacific Coast salmon (PFMC 2014) contained in the fishery management plans developed by the PFMC and approved by the Secretary of Commerce.

### **3.1 Essential Fish Habitat Affected by the Project**

The environmental effects of the proposed project may adversely affect EFH for Pacific coast salmon.

### **3.2 Adverse Effects on Essential Fish Habitat**

Replacement of the Diversion Dam includes the excavation of sediments upstream of the dam both to construct the bypass structures as well as to remove sediments that will enter the intake structure. The operation of the diversion dam which includes deflating the bladder to flush sediments from above the dam to below the diversion, will also result in headcuts that will migrate upstream when the diversion dam is lowered.

The headcut results from the difference in river elevation above and below the diversion dam. The 12 foot difference in elevation will migrate upstream until either the headcut hits a hard surface, like a bedrock outcrop, or a gradient change in the river results in the headcutting stopping its upstream migration. Hydro Electron estimates the headcut will migrate upstream approximately 800 feet. NMFS concurs with an informal U.S. Fish and Wildlife Service analysis, incorporated here by reference, based on topography maps and calculated the headcut may migrate as far as 0.5 miles upstream to the confluence with the Mowich River (Bakke 2018).

### **3.3 Essential Fish Habitat Conservation Recommendations**

Fully implementing this EFH Conservation Recommendation (CR) would protect, by avoiding or minimizing the adverse effects described in Section 3.2, above, on designated EHF for Pacific coast salmon:

1. Electron Hydro LLC should immediately develop an HCP to address adverse effects and unauthorized take associated with the operation and maintenance of the hydroelectric generating facility.

### **3.4 Statutory Response Requirement**

As required by section 305(b)(4)(B) of the MSA, the Corps must provide a detailed response in writing to NMFS within 30 days after receiving an EFH Conservation Recommendation. Such a response must be provided at least 10 days prior to final approval of the action if the response is inconsistent with any of NMFS' EFH Conservation Recommendations unless NMFS and the Federal agency have agreed to use alternative time frames for the Federal agency response. The response must include a description of measures proposed by the agency for avoiding, minimizing, mitigating, or otherwise offsetting the impact of the activity on EFH. In the case of a response that is inconsistent with the Conservation Recommendations, the Federal agency must explain its reasons for not following the recommendations, including the scientific justification for any disagreements with NMFS over the anticipated effects of the action and the measures needed to avoid, minimize, mitigate, or offset such effects (50 CFR 600.920(k)(1)).

In response to increased oversight of overall EFH program effectiveness by the Office of Management and Budget, NMFS established a quarterly reporting requirement to determine how many conservation recommendations are provided as part of each EFH consultation and how many are adopted by the action agency. Therefore, we ask that in your statutory reply to the EFH portion of this consultation, you clearly identify the number of conservation recommendations accepted.

#### **4. DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW**

The Data Quality Act (DQA) specifies three components contributing to the quality of a document. They are utility, integrity, and objectivity. This section of the opinion addresses these DQA components, documents compliance with the DQA, and certifies that this opinion has undergone pre-dissemination review.

##### **4.1 Utility**

Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users. The intended users of this opinion are the Corps. Other interested users could include Electron Hydro, the Puyallup Indian Tribe, and other interested stakeholders. Individual copies of this opinion were provided to the Corps. The format and naming adheres to conventional standards for style.

##### **4.2 Integrity**

This consultation was completed on a computer system managed by NMFS in accordance with relevant information technology security policies and standards set out in Appendix III, 'Security of Automated Information Resources,' Office of Management and Budget Circular A-130; the Computer Security Act; and the Government Information Security Reform Act.

##### **4.3 Objectivity**

***Information Product Category:*** Natural Resource Plan

***Standards:*** This consultation and supporting documents are clear, concise, complete, and unbiased; and were developed using commonly accepted scientific research methods. They adhere to published standards including the NMFS ESA Consultation Handbook, ESA regulations, 50 CFR 402.01 et seq., and the MSA implementing regulations regarding EFH, 50 CFR 600.

***Best Available Information:*** This consultation and supporting documents use the best available information, as referenced in the References section. The analyses in this opinion [*and EFH consultation, if applicable*] contain more background on information sources and quality.

***Referencing:*** All supporting materials, information, data and analyses are properly referenced, consistent with standard scientific referencing style.

***Review Process:*** This consultation was drafted by NMFS staff with training in ESA [*and MSA implementation, if applicable*], and reviewed in accordance with West Coast Region ESA quality control and assurance processes.

## 5. REFERENCES

- Anderson, P.G., B.R. Taylor, and G.C. Balch. 1996. Quantifying the effects of sediment release on fish and their habitats. Fisheries and Oceans, Canada, Canadian Manuscript Report of Fisheries and Aquatic Sciences 2346.
- Bakke, P. 2018. Electron dam effects. Unpublished.
- Barrett, J.C., G.D. Grossman, and J. Rosenfeld. 1992. Turbidity-induced changes in reactive distance of rainbow trout. Transactions of the American Fisheries Society 121:437-443.
- Bash, J., C.H. Berman, and S. Bolton. 2001. Effects of turbidity and suspended solids on salmonids. Center for Streamside Studies, University of Washington, Seattle, WA, November 2001. 72 pp.
- Battin, J., M.W. Wiley, M.H. Ruckelshaus, R.N. Palmer, E. Korb, K.K. Bartz, and H. Imaki. 2007. Projected impacts of climate change on salmon habitat restoration. Proceedings of the National Academy of Sciences of the United States of America 104(16):6720-6725.
- Bentley, K.T., D.E. Schindler, J.B. Armstrong, R. Zhang, C.P. Ruff, and P.J. Lisi. 2012. Foraging and growth responses of stream-dwelling fishes to inter-annual variation in a pulsed resource subsidy. Ecosphere 3(12):1-17. <http://dx.doi.org/10.1890/ES12-00231.1>.
- Berger, A., R. Conrad, and J. Paul. 2015. Puyallup River Juvenile Salmonid Production Assessment Project 2015. Puyallup Tribal Fisheries Division, Puyallup, WA.
- Berry, W., N.I. Rubinstein, B. Melzian, and B. Hill. 2003. The biological effects of suspended and bedded sediment (SABS) in aquatic systems: a review. USEPA, Office of Research and Development, National Health and Environmental Effects Laboratory, Narragansett, Rhode Island, August 20, 2003. 58 pp.
- Brenkman, S.J., S.C. Corbett, and E.C. Volk. 2007. Use of otolith chemistry and radiotelemetry to determine age-specific migratory patterns of anadromous bull trout in the Hoh River, Washington. Transactions of the American Fisheries Society 136:1-11.
- Cederholm, C.J., M.D. Kunze, T. Murota, and A. Sibatani. 1999. Pacific salmon carcasses: Essential contributions of nutrients and energy for aquatic and terrestrial ecosystems. Fisheries 24:6-15.
- Chan, J. 2017. Telephone conversation between Jeff Chan (USFWS) and Kristen Currens (Mason, Bruce & Girard, Inc.) on August 11, 2017.
- Cherry, S. 2016. Geomorphology and Sediment Transport Draft Study. Electron Hydro, Orting, WA.



- Copeland, T., and K.A. Meyer. 2011. Interspecies synchrony in salmonid densities associated with large-scale bioclimatic conditions in central Idaho. *Transactions of the American Fisheries Society* 140:928-942.
- Czuba, J.A.; Czuba, C.R.; Magirl, C.S.; and Voss, F.D. 2010. Channel-Conveyance Capacity, Channel Change, and Sediment Transport in the Lower Puyallup, White, and Carbon Rivers, Western Washington. Scientific Investigations Report (SIR) 2010-5240. U.S. Geological Survey, Reston, VA. 104 p.
- Glick, P., J. Clough, and B. Nunley. 2007. Sea-level Rise and Coastal Habitats in the Pacific Northwest, An Analysis for Puget Sound, Southwestern Washington, and Northwestern Oregon. National Wildlife Federation.
- Goetz, F.A., E. Jeanes, and E. Beamer. 2004. Bull Trout in the Nearshore. Preliminary Draft Report. U.S. Army Corps of Engineers, Seattle, WA.
- Good, T.P., R.S. Waples and P. Adams (Editors). 2005. Updated Status of Federally Listed ESUs of West Coast Salmon and Steelhead. U.S. Dept. Commerce, NOAA Tech. Memo. NMFS-NWFSC-66, 598 p.
- Greene, C., L. Kuehne, C. Rice, K. Fresh, and D. Penttila. 2015. Forty years of change in forage fish and jellyfish abundance across greater Puget Sound, Washington (USA): anthropogenic and climate associations. *Marine Ecology Progress Series* 525:153-170.
- Hard JJ, Myers JM, Connor EJ, *et al.* 2015. Viability criteria for steelhead within the Puget Sound Distinct Population Segment. U.S. Dept. of Commerce, NOAA Tech. Memo., NMFS-NWFSC-129, 332 p.
- IPCC (Intergovernmental Panel on Climate Change). 2007. Climate change 2007: Climate change impacts, adaptation, and vulnerability - summary for policymakers.
- Jeanes, E. 2006. Electron Project Description. R2 Resource Consultants, Inc., Redmond, Washington. Summary report prepared for Puget Sound Energy, Bellevue, Washington. January 3, 2006, 5p.
- Kerwin, John. 1999. Salmon habitat limiting factors report for the Puyallup River basin (WRIA 10). Washington Conservation Commission. Olympia, WA.
- Kerwin, John and Nelson, Tom S. (Eds.). December 2000. "Habitat Limiting Factors and Reconnaissance Assessment Report, Green/Duwamish and Central Puget Sound Watersheds (WRIA 9 and Vashon Island)." Washington Conservation Commission and the King County Department of Natural Resources.
- Lake, R.G., and S.G. Hinch. 1999. Acute effects of suspended sediment angularity on juvenile coho salmon (*Oncorhynchus kisutch*). *Canadian Journal of Fisheries and Aquatic Sciences* 56:862-867.

- Lee, S., and A.F. Hamlet. 2011. Skagit River Basin Climate Science Report. Summary report prepared for Skagit County and the Envision Skagit Project by the Department of Civil and Environmental Engineering and The Climate Impacts Group, University of Washington.
- Marks, E.L. 2016. Synopsis of Puyallup Tribal Fisheries, Adult and Juvenile Salmonid Monitoring and Enhancement Programs, Upper Puyallup River Basin, Washington. Puyallup Tribal Fisheries Division, Puyallup, WA.
- McLeay, D.J., I.K. Birtwell, G.F. Hartman, and G.L. Ennis. 1987. Responses of arctic grayling (*Thymallus arcticus*) to acute and prolonged exposure to Yukon placer mining sediment. Canadian Journal of Fisheries and Aquatic Sciences 44(3):658-673.
- Moore, J.W., D.E. Schindler, C.P. Ruff. 2008. Habitat saturation drives thresholds in stream subsidies. Ebcology 89:306-312.
- Mote, P.W., A.K. Snover, L.W. Binder, A.F. Hamlet, and N.J. Mantua. 2005. Uncertain future: climate change and its effects on Puget Sound - foundation document. A report prepared for the Puget Sound Action Team by the Climate Impacts Group (Center for Science in the Earth System, Joint Institute for the Study of the Atmosphere, University of Washington), Seattle, Washington, October 2005. 37 pp.
- National Park Service. Western Region. Department of the Interior. Historic American Buildings Survey. Historic American Engineering Record. Electron Project Flume (Puyallup Project Flume). January 1986. San Francisco, CA 94102
- Nelson, M.C., and J.D. Reynolds. 2014. Time-Delayed Subsidies: Interspecies Population Effects in Salmon. PLoS ONE 9(6): e98951. doi:10.1371/journal.pone.0098951.
- Newcombe, C.P., and D.D. MacDonald. 1991. Effects of suspended sediments on aquatic ecosystems. North American Journal of Fisheries Management 11(1):72-82.
- NMFS. 1999. Endangered and Threatened Species; Threatened Status for Three Chinook Salmon Evolutionarily Significant Units (ESUs) in Washington and Oregon, and Endangered Status for One Chinook Salmon ESU in Washington. (64 FR 14308).
- NMFS. 2006. Recovery Plan for the Puget Sound Chinook Salmon (*Oncorhynchus tshawytscha*). National Marine Fisheries Service, Northwest Region. Seattle, WA.
- NMFS. 2007. Final Listing Determination for Puget Sound Steelhead ACTION: Final rule. (72 FR 26722).
- NMFS (National Marine Fisheries Service). 2011. Anadromous Salmonid Passage Facility Design. NMFS, Northwest Region, Portland, Oregon.

- NMFS. 2011. 5-Year Review: Summary & Evaluation of Puget Sound Chinook, Hood Canal Summer Chum, Puget Sound Steelhead.
- NWFSC. 2015. Status Review Update for Pacific Salmon and Steelhead Listed under the Endangered Species Act: Pacific Northwest.
- Reid, S., and P.G. Anderson. 1999. Effects of sediment released during open-cut pipeline water crossings. *Canadian Water Resources Journal* 24:23-39.
- Rhodes, J.J., D.A. McCullough, and F.A. Espinosa Jr. 1994. A coarse screening process for potential application in ESA consultations. Columbia River Inter-Tribal Fish Commission, Technical Report 94-4, Portland, Oregon, December, 1994. 126 pp.
- Rinella, D.J., M.S. Wipfli, C.A. Stricker, R.A. Heintz, and M.J. Rinella. 2012. Pacific salmon (*Oncorhynchus* spp.) runs and consumer fitness: growth and energy storage in stream-dwelling salmonids increase with salmon spawner density. *Canadian Journal of Fisheries and Aquatic Sciences* 69:73-84.
- Soicher, A. 2008. Email between Alan Soicher, Assistant Environmental Program Manager, Washington Department of Transportation, to Ned Currence, Habitat Biologist, Nooksack Indian Tribe, September 17, 2008.
- Suttle, K.B., M.E. Power, J.M. Levine, and C. McNeely. 2004. How fine sediment in riverbeds impairs growth and survival of juvenile salmonids. *Ecological Applications* 14(4):969-974.
- Therriault, T.W., D.E. Hay, and J.F. Schweigert. 2009. Biologic overview and trends in pelagic forage fish abundance in the Salish Sea (Strait of Georgia, British Columbia). *Marine Ornithology* 37: 3-8.
- Thompson, K.G., P. Bergersen, and R.B. Nehring. 1997a. Injuries to brown trout and rainbow trout induced by capture with pulsed direct current. *North American Journal of Fisheries Management* 17:141-153.
- USGS (United States Geological Survey). 2017. The StreamStats program for Washington, online at <https://streamstats.usgs.gov/ss/>.
- Vondracek, B., J.K.H. Zimmerman, and J.V. Westra. 2003. Setting an effective TMDL: sediment loading and effects of suspended sediment on fish. *Journal of the American Water Resources Association* 39(5):1005-1015.
- Watts, C.D., P.S. Naden, D. Cooper, and B. Gannon. 2003. Application of a regional procedure to assess the risk to fish from high sediment concentrations. *The Science of the Total Environment* 314-316:551-565.
- WDOE (Washington Department of Ecology). 2018. Washington State Water Quality Assessment, 303(d) list. Water quality atlas available at: <https://fortress.wa.gov/ecy/waterqualityatlas/map.aspx>. Accessed February 8, 2018.

WDOE 2008. Lower Skagit River tributaries temperature total maximum daily load. Water quality improvement report. Water Quality Program, WDOE, Publication No. 08-10-020, Bellevue, Washington, July 2008. 252 pp.

## Appendix A

# Phase I Fish Exclusion and Removal Protocols

Diversion Repair, Spillway Replacement and  
Bank Protection Project

Prepared by Electron Hydro, LLC

March 2017

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## Phase I Fish Exclusion and Removal Protocols

### 1.0 Introduction

Electron Hydro, LLC must make significant repairs to the 113 year- old hydropower plant intake facilities located on the Puyallup River at RM 41.7.

These Phase I repairs include:

- Replacement of the 30 foot by 3-foot deep Obermeyer spillway with a 70 foot by 12-foot deep inflatable bladder spillway within the existing diversion structure.
- Repairs to the intake bulkhead to provide a coarse trash rack and sediment sluice to aid in keeping the intake window open and unobstructed.
- Repairs to the existing timber-crib diversion and apron as needed.
- Repair and replacement of the existing bank shoreline protection structures.

The repairs are needed to bring the facility into compliance with the Endangered Species Act (ESA) and thereby enable the subsequent installation and operation of sediment and fish exclusion facilities in the second phase of the project. This document describes the protocols and standards that will be followed to ensure that fish other aquatic resources such as amphibians and reptiles are excluded from work areas below the Ordinary High Water Mark (OHWM).

#### 1.1 Notification

Ten days prior to initiation of the in-water work, written notification will be sent to:

- The Puyallup Tribe of Indians
- Washington Department of Fish and Wildlife
- US Fish and Wildlife Service,
- National Marine Fisheries Service
- US Army Corp of Engineers
- Pierce County
- Puget Sound Energy

#### 1.2 Headworks Project Area

The project area is primarily located at the Electron Hydro headworks at Mile 41.7 of the Puyallup River. Work below the OHWM will occur within approximately 600 feet upstream and 800 feet downstream of the existing diversion structure. Work will be completed 'in the dry' to the extent possible in discrete areas that can be isolated from the river flow. Berms and cofferdams will be constructed on existing gravel bars using the native gravel materials. The upstream river closure and re-routing will be done using super sacks filled with native gravel/sand. This will be placed in the active river channel when flow is to be redirected. The Project area is subdivided into two zones (Refer to Drawing C-1):

- Zone 1 is upstream of the diversion structure and subdivided into:
  - East-1: right bank upstream of the diversion just below the intake to the fish ladder.
  - West-1 Left bank upstream of the diversion and includes the flume intake and spillway.
- Zone 2 is downstream of the diversion structure and subdivided into:
  - East-2 right bank downstream of the diversion and includes the downstream end of the fish ladder.

- West-2 left bank downstream of the diversion includes spillway pool and rock chute pools.

Within each of these zones, the river flows through channels where fish can be excluded and removed as in-water work is scheduled.

### 1.3 Flume De-watering and Forebay Drawdown

As the upstream cofferdam is completed, flow into the flume will be ramped down and the upper flume will be dewatered. Fish recovery will be completed in the upper flume as the flow recedes. The settling basin and forebay will be drawn down as flow diminishes however, these sections will not be completely drained. To maintain a flow of cool water into the forebay, three small tributaries will continue to flow into the flume. Bacon Creek, Burbank Creek and an unnamed spring will provide a flow of approximately 5 cfs into the forebay. During the dewatering of the flume, the trap and haul facility will continue to operate to capture fish in the forebay. The settling basin has a deep pool near the outlet which near the confluence of Bacon Creek. The influx of flow to this pool from Bacon Creek will maintain cool water which then flows into the flume at the basin.

As the flume is dewatered, a fish recovery team will walk the entire length of the flume and recover fish that may be stranded in low spots inside of the flume. Fish will be held in insulated coolers with aquarium aerators until they can be returned to the Puyallup River.

### 1.4 Project Sequencing

Sequencing of in-water work will follow the steps listed below in Table 1. In-water work will begin in Zone East-1 to prepare a temporary bypass channel over the right bank portion of the diversion structure and through the fish ladder. When the temporary bypass channel is completed, in-water work will begin in Zone West-1 and the upstream cofferdam will be completed to isolate the flume intake and spillway work area.

Table 1. Sequence and schedule of in-water work.

Task	Duration (days)	Start	Finish	Remarks
start construction	0	7/12/2017	7/12/2017	
install water and protection at upland boundary fencing	1	7/12/2017	7/13/2017	As per SWPPP
select and remove trees from left bank	1	7/13/2017	7/14/2017	For bank protection improvement
build ramps into dry river banks	1	7/14/2017	7/15/2017	for equipment access
clear and grub right bank	1	7/15/2017	7/16/2017	For bank protection improvement
build zone East-1 cofferdam	0.5	7/16/2017	7/16/2017	In the dry on gravel bar
place super sacks across East-1 zone	0.5	7/16/2017	7/17/2017	Fish exclusion and removal from work corridor



## Phase I Fish Exclusion and Removal Protocols

dewater East-1 zone	0.5	7/17/2017	7/17/2017	Monitor for fish stranding in pool
place liner in East-1 zone	1	7/17/2017	7/18/2017	
build West-1 berm from left bank	1	7/18/2017	7/19/2017	In the dry on gravel bar
move super sacks to main channel	0.5	7/19/2017	7/20/2017	Fish exclusion and removal from work corridor
move river channel to right bank	0.5	7/20/2017	7/20/2017	Fish exclusion and removal from work corridor
shut tainter gate (Plant OFF)	0	7/20/2017	7/20/2017	Fish removal from upper flume
dewater West-1 zone	1	7/20/2017	7/21/2017	Fish removal from intake pool and spillway pool
build East-2 cofferdam	4	7/21/2017	7/25/2017	Fish exclusion and removal from work corridor
dewater West-2	2	7/25/2017	7/27/2017	Fish exclusion and removal from work corridor
extend upstream cofferdam in West-1 zone	3	7/27/2017	7/30/2017	Fish exclusion and removal from work corridor
monitor daily turbidity in temp bypass channel	35	7/30/2017	9/3/2017	As per BE Conservation Measure 8
remove downstream cofferdams	4	9/3/2017	9/7/2017	Fish exclusion and removal from work corridor
restore downstream river to left bank	1	9/7/2017	9/8/2017	Fish exclusion and removal from work corridor
remove up river supersacks and open river left	1	9/8/2017	9/9/2017	Fish exclusion and removal from work corridor
remove upstream cofferdam	4	9/9/2017	9/13/2017	Fish exclusion and removal from work corridor
restore and reconfigure upstream channel	1	9/13/2017	9/14/2017	Fish exclusion and removal from work corridor
remove all equipment from in-water boundary	1	9/14/2017	9/15/2017	
commission and test new spillway	4	9/15/2017	9/19/2017	

## 2.0 Fish Exclusion/Recovery Team

The fish exclusion/recovery team will be composed of a minimum of 6 individuals including the following:

- Directing Biologist, Electron Hydro Senior Biologist, MS degree Marine and Fisheries Science, 25 years of experience in team leadership, field data collection, data analysis and report writing. Special training with electrofishing methods and over 100 hours of field experience using electrofishing equipment.
- Field Team Leader, Electron Hydro Field Biologist, BS, Wildlife and Fisheries Ecology, 7 years of experience as a fish biologist, special training with electrofishing methods.

- Fish Technicians, with training in safe handling of fish and fish collection equipment gear

Additional team members may be added as needed.

### 2.1 Team Assignments

The directing biologist will work directly with the construction staff and environmental staff to assist with scheduling work and field equipment. The directing biologist will assist with fish exclusion and monitoring tasks as needed and will be responsible for documentation and reporting of field activities

The field team leader will be responsible for the completion of field assignments to include:

- Fish exclusion from work areas
- Monitoring of air and water temperature, water turbidity, instream flow in bypass channel and fish ladder, and maintenance of field equipment
- Operation of trap and haul facility.

Fisheries technicians will be responsible to complete assigned tasks in an efficient and professional manner.

## 3.0 Fish Exclusion Methods

Work areas will be cleared of fish and aquatic fauna following the WSDOT fish exclusion protocols and standards (WSDOT 2012). Generally, a block net will be set at the upstream boundary of the work area and fish will be herded downstream. If the block nets are swept out of position by water velocity, a temporary fence will be installed for support behind the block net.

The first pass through the work area will be with a seine net that will be set at the downstream boundary of the work area. The fish exclusion team will then use a seine net to pass through the work area and capture all remaining fish between the two block nets. Additional passes with a seine net will be completed until three consecutive passes result with no captured fish. Because of high turbidity in the Puyallup River due to summer season glacial and snow melt, electrofishing methods are not recommended.

Capture fish will be transferred to opaque buckets or insulated coolers equipped with aerators for a short period until they are identified and then released back into the free-flowing river. Large fish will be held separately from small fish to avoid predation. Water will be exchanged in the buckets if fish are held longer than ten minutes. Bull trout, Chinook salmon and steelhead trout will be treated with deference and will be processed as soon as possible. Adult bull trout and Chinook salmon assumed to be migrating upstream will be released upstream of the project site, kelts and all other life stages and species will be released downstream of the project site. The following data will be recorded for fish captured within at each work area:

- Number of fish
- Species
- Life stage; fry, smolt, juvenile, adult, kelt
- Condition; wounds

- Marks; adipose clip, fin clip,
- Release point
- Photographs of bull trout will be taken

Work tasks within each fish exclusion corridor are expected to be completed within one 16-hour work period. Therefore, block nets will be installed at the beginning of the day and removed at the end of the day. When block nets are to remain in place over night or, for several days, the nets will be inspected for condition and impinged fish at the beginning of the day, mid-day and at the end of the day.

### 3.1 Special Circumstances

Fish habitat conditions in each work area are expected to vary and the directing biologist will use professional judgement to adapt the general fish exclusion methods based on safety of crew, safe handling of fish, and efficiency. These special circumstances include:

- Upstream herding of fish
- Pools to be dewatered with pumps especially at flume intake and below the spillway
- Dewatering of the flume
- Drawdown at the forebay

An initial upstream pass of a seine net to herd fish upstream and then set the upstream block net may be a more efficient method in some situations. After the initial pass and setup of the upstream blocknet, the general fish removal methods described above will be followed.

Pools directly upstream of the flume intake and downstream of the spillway are expected to require pumping as the project work site is dewatered. All pumps will be equipped with fish screens at the intake of the pump. Fish will be captured with seine nets as the pools are being dewatered. Fishery technicians will monitor the pools to ensure that fish are not stranded along the pool margins. Pumping will temporarily stop when pools are at approximately 2 feet deep, a seine net will then be used to capture all remaining fish. When three consecutive passes result with no fish captured, pumping of the pools will resume.

As the upper flume is drained, three fishery technicians will walk the length of the upper flume toward the settling basin to herd fish downstream and recover fish that are stranded in pools formed in low spots within the flume. Fish will be captured with a seine and dip nets and transferred into insulated totes equipped with an aquarium aerator that are carried along on the railcar on top of the flume. A fishery technician onboard the railcar will identify and enumerate the captured fish. At the settling basin, a blocknet will be set at the downstream end of the flume to prevent fish from re-entering the upper flume. All captured fish will be transferred to a trailer tank and returned to the Puyallup River at the downriver release point below the powerhouse.

As the flume is drained, the forebay will be drawdown to the elevation below the threshold of the flume outlet. During this period, the trap and haul facility will continue to be operated with

the guide net kept in place. Fish captured in the trap will be identified, enumerated and released into the Puyallup River downstream of the tailrace. The forebay will not be emptied therefore fish may be present during the work period. There are three locations of inflow into the flumeway, Bacon Creek, Burbank Creek and an unnamed spring. This inflow will continue to provide cool water into the forebay throughout the work period.

If work is scheduled in the lower flume, then blocknets will be set at the upstream inlet of the lower flume and fish will be herded and recovered from the lower flume as described above. When the fish crew arrives at the forebay, a block net will be set at the downstream end of the forebay and captured fish will be transferred to a trailer tank and returned to the Puyallup River.

### 3.2 Equipment

The following equipment will be in good working condition:

- 4 Seine nets; Upstream blocknet, downstream blocknet, 2 working seines; 6 feet X 100 feet
- 3 Flume seine and block nets; 6 feet X 20 feet.
- Dipnets (5)
- Aquarium dip nets
- Buckets; 5 gallon opaque color with lids
- Insulated coolers
- 12 volt aerator pumps (3)
- Fence posts and mesh fencing to reinforce blocknets as needed.
- Seine twine, wire, zip ties, misc. field supplies
- Monitoring equipment:
  - Thermometers and Onset tidbit temperature monitors
  - Turbidity meter
  - Conductivity meter
  - Staff gauges
  - Electrofisher; Smith-Root model LR-24 or similar, if needed.

### 4.0 Monitoring

Water quality parameters will be monitored through the work period at two stations. One station upstream of the project boundary and one station downstream of the project boundary.

At the beginning of each work day the following data will be recorded at the upstream station:

- Air and water temperature
- Turbidity
- Conductivity
- Instream flow (USGS Station 12092000)

As work progresses through the day, the following data will be recorded at the downstream station located in the main channel near the flume flood gates approximately 1500 feet downstream from the diversion structure.

- Air and water temperature

- Turbidity
- Instream flow (USGS Station 12092000 minus production flow)

Air temperature and water temperature will also be continuously recorded with monitoring units stationed at the settling basin and the forebay. Water elevation and temperature will also be continuously recorded in the fish ladder throughout the work period.

## 5.0 Documentation

A progress report will be submitted after the Phase I project has been completed and the new spillway and intake are commissioned. The report will be submitted to Puyallup Tribal Fisheries, Washington State Dept. of Fish and Wildlife, US Fish and Wildlife Service, and National Marine Fisheries Service. The report will summarize methods and results of fish exclusion and recovery and monitoring of water quality parameters. Data will include:

- Number of fish captured in each zone
- Species
- Life stage; fry, juvenile, adult, kelt
- Condition; wounds
- Marks; adipose clip, fin clip,
- Release point
- Photographs of bull trout
- Air and water temperature
- Instream flow in the Puyallup River and fish ladder
- Turbidity
- Conductivity (if required)

## 6.0 References

Washington State Department of Transportation (WSDOT). 2012. WSDOT Fish Exclusion Protocols and Standards. [www.wsdot.wa.gov/NR/rdonlyres/70E7E285-ECC6-41BA-A2DF-87FD0D68128D/0/BA\\_FishHandling.pdf](http://www.wsdot.wa.gov/NR/rdonlyres/70E7E285-ECC6-41BA-A2DF-87FD0D68128D/0/BA_FishHandling.pdf)